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THE GRADUATE SCHOOL

Arts and Sciences

Education

Business

Engineering

NORTHEASTERN UNIVERSITY

C O L L E G E S O F

Liberal Arts
Education
Business Administration
Engineering

BULLETIN

1960-1961



(COEDUCATIONAL)

BOSTON 15, MASSACHUSETTS

January, 1960

Office Hours

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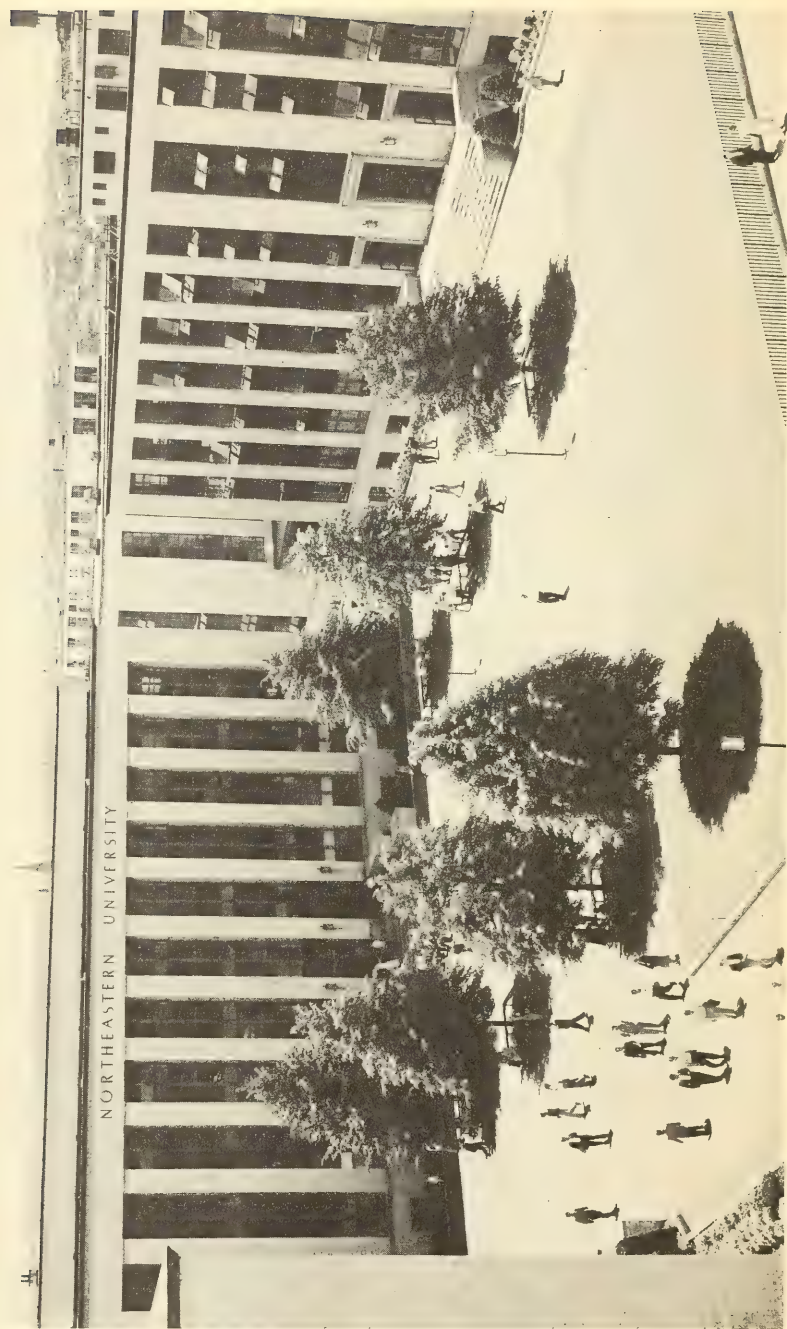
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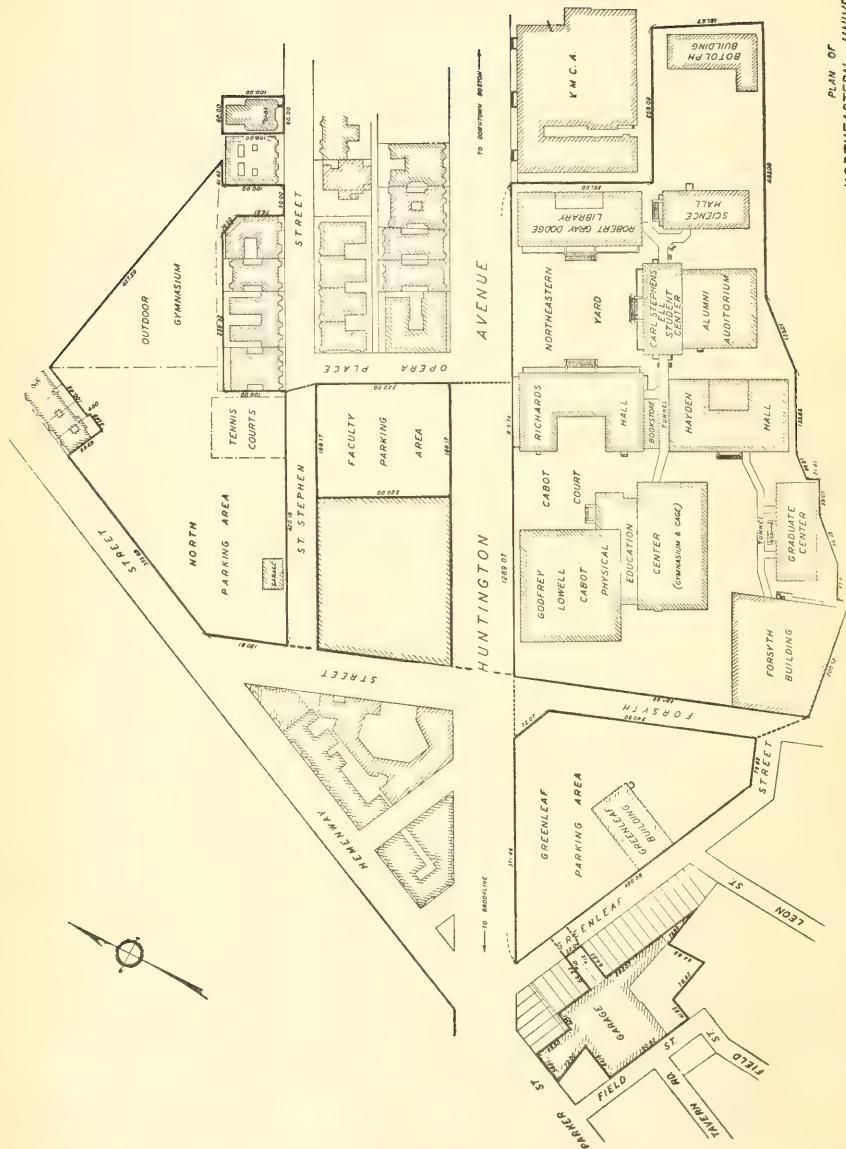
COLLEGE OF EDUCATION

COLLEGE OF BUSINESS ADMINISTRATION

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PLAN OF
NORTHEASTERN UNIVERSITY
BOSTON, MASSACHUSETTS
JUNE 1939

SCALE
0 50 100 200 400

Freshman Academic Calendar

SEPTEMBER, 1960, TO SEPTEMBER, 1961

Schedule for Division S

TERM 1 — 10 WEEKS

September 7 (Wed.): REGISTRATION for Div. S. Students must register by noon on this date if they wish places reserved for them in the entering class.

September 7-9 (Wed.-Fri.): ORIENTATION WEEK EXERCISES. Attendance of all Div. S Freshmen is required.

September 12 (Mon.): Classes begin at 1 p.m. on special schedule.

October 12 (Wed.): Columbus Day. No classes.

November 11 (Fri.): Veterans' Day. No classes.

November 14-19 (Mon.-Fri.): Final examination period for Term 1.

TERM 2 — 10 WEEKS

November 21 (Mon.): Classes begin at 1 p.m. on special schedule.

November 24 (Thurs.): Thanksgiving Day. No classes.

December 23 (Fri.): Classes end at 5 p.m. for Christmas recess and reconvene December 28 at 9 a.m.

January 2, 1961 (Mon.): New Year's Day. No classes.

January 23-27 (Mon.-Fri.): Final examination period for Term 2.

TERM 3 — 10 WEEKS

January 30 (Mon.): Classes begin at 1 p.m. on special schedule.

February 22 (Wed.): Washington's Birthday. No classes.

April 3-7 (Mon.-Fri.): Final examination period for Term 3.

SOPHOMORE YEAR

Students take either APRIL or AUGUST term

TERM 4 — 5 WEEKS

April 10 (Mon.): Classes begin at 1 p.m. on special schedule.

April 19 (Wed.): Patriots' Day. No classes.

May 13 (Sat.): End of April five-week term for Div. S students.

TERM 4 — 5 WEEKS

August 7 (Mon.): Beginning of optional five-week term for those students who did not attend in April. Classes begin at 11 a.m. on special schedule.

September 4 (Mon.): Labor Day. No classes.

September 9 (Sat.): End of August summer term.

September 11 (Mon.): REGISTRATION for Div. A Upperclassmen. Classes begin at 1 p.m. on special schedule.

Schedule for Division N

TERM 1 — 10 WEEKS

November 16 (Wed.): REGISTRATION for Div. N. Students must register by noon on this date if they wish places reserved for them in the entering class.

November 16-18 (Wed.-Fri.): ORIENTATION WEEK EXERCISES. Attendance of all Div. N Freshmen is required.

November 21 (Mon.): Classes begin at 1 p.m. on special schedule.

November 24 (Thurs.): Thanksgiving Day. No classes.

December 23 (Fri.): Classes end at 5 p.m. for Christmas recess and reconvene December 28 at 9 a.m.

January 2, 1961 (Mon.): New Year's Day. No classes.

January 23-27 (Mon.-Fri.): Final examination period for Term 1.

TERM 2 — 10 WEEKS

January 30 (Mon.): Classes begin at 1 p.m. on special schedule.

February 22 (Wed.): Washington's Birthday. No classes.

April 3-7 (Mon.-Fri.): Final examination period for Term 2.

TERM 3 — 10 WEEKS

April 10 (Mon.): Classes begin at 1 p.m. on special schedule.

April 19 (Wed.): Patriots' Day. No classes.

May 30 (Tues.): Memorial Day. No classes.

June 12-16 (Mon.-Fri.): Final examination period for Term 3.

SOPHOMORE YEAR

Students take either JUNE or AUGUST term

TERM 4 — 5 WEEKS

June 19 (Mon.): Classes begin at 11 a.m. on special schedule.

July 4 (Tues.): No classes.

July 22 (Sat.): End of June five-week term for Div. N students.

TERM 4 — 5 WEEKS

August 7 (Mon.): Beginning of optional five-week term for those students who did not attend in June. Classes begin at 11 a.m. on special schedule.

September 4 (Mon.): Labor Day. No classes.

September 9 (Sat.): End of August summer term.

September 11 (Mon.): REGISTRATION for Div. A Upperclassmen. Classes begin at 1 p.m. on special schedule.

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Office 21 Forsyth Building
- DAVID ROGER FREEMAN, B.S. *Assistant Professor of Industrial Engineering*
Office 104 Forsyth Building

JOB E. FUCHS, M.D. Office 203 Commonwealth Avenue	<i>Assistant to the University Physician</i>
JAMES A. FULLER, B.A., M.A. Office 205 Dodge Library	<i>Instructor in English</i>
NORBERT LUCENE FULLINGTON, B.A., M.A. Office 103 Science Hall	<i>Assistant Professor of History</i>
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SAMUEL MERRITT GIVEEN, A.B., M.A. Office 325 Richards Hall	<i>Assistant Professor of Mathematics</i>
MICHAEL JUDA GLAUBMAN, M.S., Ph.D. Office 302 Graduate Center	<i>Assistant Professor of Physics</i>
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CHARLES MARTEL GOOLSBY, B.S., M.S., Ph.D. Office 422 Science Hall	<i>Assistant Professor of Biology</i>
JOSEPH EDWARD GORDON, M. Sgt., U.S.A. Office 2 Greenleaf Building	<i>Instructor in Military Science and Tactics</i>
NORMAN D. GREENWALD, B.A., M.A., Ph.D. Office 108 Science Hall	<i>Assistant Professor of Government</i>
WILLIAM E. R. GREER, M.D. Office 203 Commonwealth Avenue	<i>Assistant to the University Physician</i>
JOHN PAUL GREGG, M. Sgt., U.S.A. Office 202 Greenleaf Building	<i>Instructor in Military Science and Tactics</i>
RICHARD EDWARD GROJEAN, B.S., M.S. Office 302 Graduate Center	<i>Associate Professor of Physics</i>
CARLO EDWARD GUBELLINI, B.S., M.B.A. Office 206 Hayden Hall	<i>Associate Professor of Business Management</i>
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MYRON C. HAMER, B.S., A.M. Office 345 Richards Hall	<i>Assistant Professor of Mathematics</i>
KENNETH ROYDEN HANCOCK, JR., B.S. Office 252 Richards Hall	<i>Assistant Professor of Co-ordination</i>
HARRY NEWTON HARDSOG, B.S., M.S., P.E. (Mass.) Office 302 Graduate Center	<i>Assistant Professor of Physics</i>
LEONARD MILTON HAVENS, Capt., U.S.A., B.S. Office 201 Greenleaf Building	<i>Assistant Professor of Military Science and Tactics</i>
SIDNEY HERMAN, B.S., M.A. Office 221 Hayden Hall	<i>Assistant Professor of Economics</i>
WHEATON ARNOLD HOLDEN, A.B., M.A., Office 415 Hayden Hall	<i>Assistant Professor of Art</i>

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Professor of Economics and Chairman of the Department
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Instructor in Military Science and Tactics
 Office 202 Greenleaf Building
- JAMES FRANCIS HOUSTON, Sfc., U.S.A.
Instructor in Military Science and Tactics
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- CALVIN RAY HOWARD, B.S.
Research Associate
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- VICTOR ELLIOTT HOWES, A.B., M.A., Ph.D.
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Assistant Professor of Graphic Science
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Assistant Professor of Chemistry
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- EARL LESLIE JORDAN, JR., M. Sgt., U.S.A.
Instructor in Military Science and Tactics
 Office 2 Greenleaf Building
- WILLIAM EMMITT JUSTICE, Sgt., U.S.A.
Instructor in Military Science and Tactics
 Office 132 Forsyth Building
- KERKOR KASSABIAN, B.S.
Instructor in Physical Education and Athletic Team Trainer
 Office 111 Cabot Physical Education Center
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Professor of Industrial Engineering and Chairman of the Department
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Professor of Business Management and Chairman of the Department
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Assistant Professor of Electrical Engineering
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Visiting Professor of Economics
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Assistant Professor of Graphic Science
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Professor of Physics and Chairman of the Department
 Office 302 Graduate Center

ELEANOR WATTS LAMBERT, B.S., M.B.A. Office 150 Richards Hall	<i>Assistant Director of Admissions</i>
DANIEL JOSEPH LANE, M. Sgt., U.S.A. Office 2 Greenleaf Building	<i>Instructor in Military Science and Tactics</i>
GEORGE MARTIN LANE, M.D. Office 314 Commonwealth Avenue	<i>Associate Professor of Hygiene and College Physician</i>
ROBERT STEVENSON LANG, B.S., Ed.M. Office 400 Dodge Library	<i>Assistant Professor of Graphic Science</i>
GIOVANNI LANZA, Ph.D. Office 302 Graduate Center	<i>Associate Professor of Physics</i>
EARLE R. LASTE, B.S., M.S. Office 114 Hayden Hall	<i>Instructor in Electrical Engineering</i>
FRANK DAVID LEARY, Sfc., U.S.A. Office 202 Greenleaf Building	<i>Instructor in Military Science and Tactics</i>
JOSEPH ANTHONY LEARY, B.S., Ed.M. Office 345 Richards Hall	<i>Assistant Professor of Mathematics</i>
THOMAS JOSEPH LEARY, A.B., M.A., Ph.D. Office 221 Hayden Hall	<i>Assistant Professor of Economics</i>
MARY JOSEPHINE LEE, B.A., Ed.M. Office 302 Hayden Hall	<i>Instructor in Education</i>
JOSEPH HAROLD LENNEY, S.B., M.S. Office 101 Botolph Building	<i>Assistant Professor of Civil Engineering</i>
HOMER CHARLES LITTLEFIELD, B.S. Office 252 Richards Hall	<i>Assistant Professor of Co-ordination</i>
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NORMAN BERTRAM LOVEJOY, Capt., U.S.A., B.S., M.S. Office 204 Greenleaf Building	<i>Assistant Professor of Military Science and Tactics</i>
JACK AUGUSTINE LUCIDO, 1st Lt., U.S.A., B.A. Office 201 Greenleaf Building	<i>Assistant Professor of Military Science and Tactics</i>
W. FAY LUDER, A.B., Ph.D. Office 474 Richards Hall	<i>Professor of Chemistry</i>
JOSEPH JOHN LYNCH, Sfc., U.S.A. Office 4 Greenleaf Building	<i>Instructor in Military Science and Tactics</i>
IVORY L. LYONS, A.B., A.M., Ph.D. Office 221 Hayden Hall	<i>Assistant Professor of Economics</i>
LAWRENCE HOWARD MALCHMAN, S.B., Ed.M., C.P.A. Office 202 Hayden Hall	<i>Associate Professor of Accounting</i>
ROBERT JOSEPH MANGONES, Capt., U.S.A., B.C.E. Office 204 Greenleaf Building	<i>Assistant Professor of Military Science and Tactics</i>
PASQUALE MARINO, B.S. Office 75 Richards Hall	<i>Instructor in Mechanical Engineering</i>
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EVERETT CARTER MARSTON, A.B., M.A. Office 308 Ell Student Center	<i>Professor of English</i>

- LARKIN DANIEL MARTIN, Lt. Col., U.S.A., B.S.
Office 204 Greenleaf Building *Assistant Professor of Military Science and Tactics*
- ROBERT N. MARTIN, B.S., M.S.
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- H. STEPHEN SCHLOSS, A.B. *Instructor in Mathematics*
Office 325 Richards Hall

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- CHARLES FREEMAN SEAVERS, JR., A.B., Ed.M., C.A.G.S. *Associate Professor of Co-ordination*
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- DONALD CHADSEY SOULE, Sfc., U.S.A. *Instructor in Military Science and Tactics*
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- ERNEST LINCOLN SPENCER, B.S., M.S., P.E. (Mass.) *Associate Professor of Civil Engineering*
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Office 456 Richards Hall
- NORMAN ANTON SPIRO, Capt., U.S.A., B.A. *Assistant Professor of Military Science and Tactics*
Office 2 Greenleaf Building

-
- CARL EDWARD STAAB, M. Sgt., U.S.A.
Office 203 Greenleaf Building *Instructor in Military Science and Tactics*
- VICTOR RICHARD STAKNIS, B.S., M.A., Ph.D.
Office 325 Richards Hall *Associate Professor of Mathematics*
- JOHN EDWARD STANIS, Major, U.S.A., B.S.
Office 238 Forsyth Building *Assistant Professor of Military Science and Tactics*
- FREDERICK ARLINGTON STEARNS, B.S., M.S., P.E. (Mass.)
Office 75 Richards Hall *Professor of Mechanical Engineering*
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Office 275 Richards Hall *Assistant Director of Public Relations*
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Office 345 Richards Hall *Professor of Mathematics and Chairman of the Department*
- RAIMUNDAS SUKYS, B.S.
Office 103 Greenleaf Building *Research Assistant*
- GERALD RUSSELL TATTON, S.B., M.B.A.
Office 104 Ell Student Center *Associate Professor of Physical Education and Head Coach of Track and Cross Country*
- WILLIAM MAXFIELD TRIPP, Sfc. U.S.A.
Office 202 Greenleaf Building *Instructor in Military Science and Tactics*
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Office 111 Hayden Hall *Instructor in Electrical Engineering*
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Office 400 Dodge Library *Assistant Professor of Graphic Science*
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Office 348 Richards Hall *Assistant Professor of Education and Assistant Director of the Testing and Counseling Center*
- DONALD SKEELE TUCKER, A.B., A.M., Ph.D.
Office 209 Hayden Hall *Visiting Professor of Business Finance*
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Office 101 Science Hall *Lecturer in Philosophy*
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Office 205 Dodge Library *Instructor in English*
- PATRICIA M. VAJDA, A.B., M.A.
Office 206 Dodge Library *Instructor in English*
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Office 456 Richards Hall *Assistant Professor of Chemistry*

- LOUIS VRETTOS, B.S., M.A., Ed.D. *Assistant Professor of Co-ordination*
Office 253 Richards Hall
- HAROLD ARTHUR WALKER, A.B. *Assistant Professor of Physical Education and*
Assistant Director of the Department
Office 111 Cabot Physical Education Center
- JOSEPH EVERETT WALLACE, Capt., U.S.A., B.A., M.Ed. *Assistant Professor of Military Science and Tactics*
Office 3 Greenleaf Building
- THOMAS HOMKOWYCZ WALLACE, S.B., A.M., Ph.D. *Associate Professor of Physics*
Office 302 Graduate Center
- WILLIAM WALLACE, S.B., M.A. *Associate Professor of Mathematics*
Office 325 Richards Hall
- A. BERTRAND WARREN, A.B., M.A., Ph.D. *Professor of Psychology and Chairman of the Department*
Office 354 Richards Hall
- WOODROW N. WARREN, Major, U.S.A., B.A., M.A. *Assistant Professor of Military Science and Tactics*
Office 2 Greenleaf Building
- EDWARD THURSTON WATLING, Capt., U.S.A., B.S. *Assistant Professor of Military Science and Tactics*
Office 2 Greenleaf Building
- GEORGE BAKER WELCH, B.S., Ph.D. *Professor of Physics*
Office 302 Graduate Center
- ANNIE M. WELLES, B.S. *Instructor in Physical Education for Women*
Office 111 Cabot Physical Education Center
- HERSHEL EUGENE WELLS, Sfc., U.S.A. *Instructor in Military Science and Tactics*
Office 201 Greenleaf Building
- ROBERT LIVSEY WELLS, B.S., M.A. *Assistant Professor of Art*
Office 415 Hayden Hall
- ROBERT NEWMAN WIENER, A.B., M.S., Ph.D. *Assistant Professor of Chemistry*
Office 475 Richards Hall
- R. GREGG WILFONG, A.B., M.A. *Associate Professor of Government and Chairman of the Department*
Office 108 Science Hall
- EDWIN ALVIN WILKINS, M. Sgt., U.S.A. *Instructor in Military Science and Tactics*
Office 2 Greenleaf Building
- EDWARD RICE WILLETT, B.S., M.A., Ph.D. *Professor of Finance and Chairman of the Department*
Office 209 Hayden Hall
- ROYCE COURTLAND WILLIAMS, Capt., U.S.A., B.S. *Assistant Professor of Military Science and Tactics*
Office 202 Greenleaf Building
- JACOB WIREN, B.S., M.S. *Assistant Professor of Research in Communications*
Office 100 Greenleaf Building

KENNETH S. WOODARD, B.S. Office 400 Dodge Library	<i>Instructor in Graphic Science</i>
ROBERT LAWRENCE WRIGHT, JR., B.S. Office 23 Forsyth Building	<i>Instructor in Mechanical Engineering</i>
ALVIN JAY YORRA, B.S., M.S. Office 75 Richards Hall	<i>Assistant Professor of Mechanical Engineering</i>
JOSEPH PETER ZABILSKI, B.S. Office 104 Ell Student Center	<i>Professor of Physical Education and Assistant Director of Athletics</i>
HAROLD SEYMOUR ZAMANSKY, B.S., Ph.D. Office 354 Richards Hall	<i>Assistant Professor of Psychology</i>
SAVERIO ZUFFANTI, B.S., M.A. Office 456 Richards Hall	<i>Professor of Chemistry</i>
MANUEL ZYMELMAN, B.S., M.S., Ph.D. Office 221 Hayden Hall	<i>Assistant Professor of Economics</i>

Professors Emeriti

ROBERT BRUCE, B.C.S., M.C.S.	<i>Professor Emeritus of Accounting Res. 12 Elliot St., Winthrop</i>
JOSEPH ARTHUR COOLIDGE, S.B., M.A.	<i>Professor Emeritus of Physics Res. 20 Martin St., Cambridge</i>
CARL DAVID JOHNSON, A.B., M.A.	<i>Professor Emeritus of Physics Res. Lakeland, Florida</i>
JOSEPH WILLIAM ZELLER, S.B., M.E., P.E. (Mass.)	<i>Professor Emeritus of Mechanical Engineering Res. 1471 Washington St., West Newton</i>

Aims and Scope of the University

NORTHEASTERN UNIVERSITY is incorporated as a philanthropic institution under the General Laws of Massachusetts. The State Legislature, by special enactment, has given the University general degree granting powers.

The Corporation of Northeastern University consists of men who occupy responsible positions in business and the professions. This Corporation elects from its membership a Board of Trustees in whom the control of the institution is vested. The Board of Trustees has four standing committees: (a) an Executive Committee which has general supervision of the financial and educational policies of the University; (b) a Committee on Facilities which has general supervision over the building needs of the University; (c) a Committee on Funds and Investments which has the responsibility of administering the funds of the University; (d) a Committee on Development which is concerned with furthering the development plans of the University.

Founded in 1898, Northeastern University, from its beginning, has had as its dominant purpose the discovery of human and social needs and the meeting of these needs in distinctive and highly serviceable ways. While subscribing to the most progressive educational thought and practice, the University has not duplicated the programs of other institutions but has sought "to bring education more directly into the service of human needs."

The following is a brief outline of the principal types of educational opportunities offered by the University.

In the Field of Liberal Arts

The College of Liberal Arts offers majors in the usual fields of the arts and sciences leading to the degrees of Bachelor of Arts and Bachelor of Science. With the exception of pre-professional programs, day curricula are normally five years in length and operated on the Co-operative Plan. However, in all majors except Chemistry and Physics, qualified students, with the approval of the Dean, may elect to complete the requirements for the degree on a full-time plan in four years.

The College of Liberal Arts offers certain of its courses during evening hours, constituting a program of three years' duration equivalent in hours to one-half the requirements for the A.B. or S.B. degree. The degree of Associate in Arts is conferred upon those who complete this program. A complete A.B. program is also offered in the evening division with curricula in Economics, English, History and Government, and Sociology.

The Division of Arts and Sciences of the Graduate School provides evening programs of graduate study in Chemistry, Mathematics, Physics and Labor Economics leading to the degree of Master of Arts or Master of Science.

In the Field of Education

The College of Education offers the option of study on the conventional four-year full-time plan or on the five-year Co-operative Plan. Both programs lead to the degree of Bachelor of Science in Education. These are designed

particularly to meet the needs of high school graduates who desire to prepare themselves for teaching and administrative positions in elementary and secondary schools.

During late afternoons, evenings, and Saturday mornings, the Division of Education of the Graduate School also sponsors graduate courses for teachers in service and leading to the degree of Master of Education.

In the Field of Business

The College of Business Administration offers five-year co-operative curricula in Accounting, Business Management, Finance and Insurance, Industrial Relations, and Marketing and Advertising leading to the degree of Bachelor of Science in Business Administration.

The School of Business — operated during evening hours — offers undergraduate curricula leading to the degree of Bachelor of Business Administration in Accounting, Management, Law and Business, Engineering and Management, Liberal Arts and Business. For students who because of occupational reasons desire shorter programs concentrating in specific areas, Institutes awarding the certificate are offered in various fields.

The Division of Business of the Graduate School provides an evening program of graduate study leading to the degree of Master of Business Administration.

In the Field of Engineering

The College of Engineering offers five-year co-operative curricula in Civil, Mechanical, Electrical, Chemical, and Industrial Engineering leading to the degree of Bachelor of Science with specification according to the department in which the student qualifies.

Graduate co-operative curricula in Civil, Mechanical and Electrical Engineering are also offered for a limited number of students.

The Division of Engineering of the Graduate School offers during evening hours graduate programs of instruction leading to the degree of Master of Science in Civil, Mechanical, and Electrical Engineering, in Engineering Management, in Communications and in Engineering Mechanics. These curricula are designed to provide engineering graduates with opportunities for further professional development.

The Lincoln Institute offers during evening hours programs leading to the degrees of Associate in Science in Chemistry and Associate in Engineering in Civil, Mechanical, Electrical, Electronic, and Industrial Engineering.

Buildings and Facilities

Location

Northeastern University is located on Huntington Avenue in the Back Bay section of Boston. The main administrative offices of the University are located in Richards Hall.

The chief railroad centers of Boston are the North and South Stations. To reach the University from the North Station, board an MTA subway car going to Park Street and transfer there to any Huntington Avenue car. To reach the University from the South Station, board a Cambridge-bound subway train and transfer at Park Street to a Huntington Avenue car. The "Northeastern" station is the first stop outside the subway.

Huntington Avenue Campus

The principal educational buildings of Northeastern University are located on a sixteen-acre site in the Back Bay section of Boston. Only one block to the west of the University lie the famous Boston Museum of Fine Arts and the beautiful public gardens-park reservation known as "The Fenway." The newer buildings of the Huntington Avenue Campus are pictured in the center spread of this catalog, following page 51.

Following a long-range development plan, University facilities have expanded substantially in recent years. In addition to the seven buildings constructed within the last two decades, several modernized older buildings are available for specialized uses. The newer buildings on the campus are interconnected by means of tunnels, so that the students may go from building to building without going out of doors in inclement weather. All of the buildings are used in common by the students of the four colleges.

In addition to classrooms and instructional offices, the principal buildings include the following:

Botolph Building — Civil Engineering Laboratories

Cabot Physical Education Center — Gymnasium, Cage, Rifle Range

Dodge Library — Library, Drawing Rooms

Ell Student Center — Student Activities, Health Department, Chapel, Auditorium, and University Commons.

Forsyth Building — Industrial and Mechanical Engineering Laboratories

Graduate Center — Administrative Offices of the Graduate School, Physics Laboratories, and Cafeteria.

Greenleaf Building — ROTC Headquarters, Research Facilities

Hayden Hall — Evening Division Offices, Business, Education, and Electrical Engineering Laboratories, Art Studio.

Richards Hall — Administrative Offices, Mechanical Engineering, Psychology and Chemistry Laboratories, Bookstore

Science Hall — Chemical Engineering and Biology Laboratories

The Co-operative Plan

What It Is

The Co-operative Plan of Education is founded on the educational philosophy that supervised employment in the occupational field for which a student is training enhances comprehensive learning and vocational adaptation. It utilizes, in addition to the usual classroom and laboratory exercises, the practical values of the work-a-day-world environment, thereby enabling the student not only to become acquainted with certain job skills and operations concurrently with his academic training but also to develop his confidence and capacity to arrive at intelligent conclusions based upon a knowledge of practice as well as of theory.

The Co-operative Plan is particularly designed to serve the needs of the recent high school graduate rather than the older, more mature student who already may have had considerable work experience.

All Northeastern co-operative curricula are five years in length, comprising a freshman year of three consecutive ten-week terms of academic study followed by four upperclass years on the Co-operative Plan.

How It Works

The Co-operative Plan works in the following manner. Upperclassmen, including both men and women, are divided into two nearly equal groups, one of which is called Division A and the other Division B. Each student is assigned a job with some business or industrial concern. The Division A students start the college year with a term of classroom work, while the Division B students start the year with a term at co-operative work. At the end of that term, the Division A students go out to work with a co-operating firm, while their places in the classrooms are then taken by their alternates, the corresponding Division B students. When the next term has passed, the Division A students return to college and the Division B students resume their co-operative work. The alternation of work and classroom study continues throughout the year so that each upperclassman has two terms of ten weeks and one of five weeks at college, two terms — one of ten weeks and one of sixteen weeks — at co-operative work, and a one-week vacation.

Similarly, each co-operating employer is thus assured of continuous service of a pair of co-operative students alternating with each other throughout the calendar year. This assurance naturally tends to stabilize employment and encourages the co-operation of employers.

Faculty Co-ordinators

Each student is assigned to a co-ordinator who is responsible for all phases of the co-operative work program for his group of students. He interviews them during the freshman year and discusses with them various vocational objectives and answers such questions as the students may have in regard to the many activities of business and industry. He studies them in the light of their physical condition, scholastic attainment, interests, aptitudes, and other factors bearing upon their qualifications for vocational assignment. These interviews culminate in an agreement between the student and his co-ordinator regarding the co-operative assignment on which the student will be placed. During each of the terms at college immediately succeeding a term at co-operative work, the co-ordinator

confers with the student concerning the job experiences acquired and other matters relating to vocational adjustment or personal problems while on the job. The reports of the employer on the achievements and performance of the student are discussed and interpreted in the interest of further co-ordination and more effective learning. In this way the progress of all students is observed and co-ordinated with their college work to the end that maximum values are obtained from their training at Northeastern.

Placement

The co-ordinator visits co-operating firms and arranges with them for the employment of students under his charge. The range of opportunities available to Northeastern students is wide, including practically all occupational activities for which their academic training, personal attributes, and vocational aptitudes qualify them. In general, the first year of co-operative work can be expected to be of a routine nature through which students may prove their fitness for more responsible work. A job assignment directly related to the student's field of study and vocational training is the prime objective of the co-ordinator. The jobs upon which Northeastern students are employed are in no sense protected opportunities or purely observational assignments. They are regular jobs under actual business conditions and are held in competition with other sources of supply. The only special privilege accorded Northeastern students is that of attending college on the Co-operative Plan and the opportunity to merit by superior performance progressive advancement on the job.

Because of uncertainties of business conditions, as well as other reasons beyond its control, the University cannot and does not guarantee to place students. However, past experience has demonstrated that students who are willing and capable of adapting themselves to existing conditions are almost never without employment except in periods of severe industrial depression.

Supervision and Guidance

While the University does not adopt a paternal attitude toward co-operative work, it nevertheless assumes certain responsibilities toward students and co-operating firms. Co-ordinators visit regularly each job to which students in their charge are assigned. They solicit from the employer an oral report upon the student's progress and achievement. This supplements the card report sent to the co-ordinator at the close of each work term. Any adjustments that may have seemed necessary or advisable are arranged at this time. Progress on assignments, schedules of training, advancement, and transfers to new responsibilities are discussed and evaluated.

Through a series of co-operative work reports prepared during their working periods, students are led to analyze their jobs and to develop a thoughtful and investigative attitude toward their working environment. A most important phase of co-operative work is the opportunity afforded for guidance by the frank discussion of actual problems encountered on the job. The intimate contact between co-ordinator and student is of great worth in helping the student to get the most value from the co-operative work assignment. While the University endeavors to provide every possible opportunity for its students, it expects them at the same time to take the initiative and to assume the responsibility involved in their individual development. To every student are available the counsel and guidance

of the faculty, and every resource at its disposal. But the faculty does not coerce students who are uninterested or unwilling to think for themselves.

The Co-operative Plan is thus designed specifically to provide actual working opportunities which afford the students practical experience, give meaning to their program of study, and train them in reliability, efficiency, and teamwork.

Location of Work

It is the policy of the University to assign students to co-operative work within commuting distance of their homes. This is not always possible, however, and at times it may be necessary for students to live away from home in order to obtain satisfactory and desirable co-operative work assignments.

Types of Co-operative Work

In so far as possible students are placed at co-operative work in that general field for which they express preference provided that aptitude, physical ability, temperament, and other personal qualities appear to fit them for this field. Usually students are placed first in those jobs of an organization where they may learn the fundamental requirements of the business.

For example, the first year of a training program in a manufacturing establishment might be as an operator of machines. This provides the opportunity to acquire intimate knowledge of the equipment, methods, and operations of some of the processing departments of raw materials and products in process of manufacture. The second year might be as an expeditor or on assignments with the maintenance and installation department. Such work would require contact with the several production and operating departments of the plant and would provide the opportunity for a comprehensive and correlated study of all operations, plant layout, routing of raw, semi-processed, and finished materials — in other words, a perspective view of the interrelationship of departments. By this time, the student will have progressed to the academic stage where "application" courses will be included in the program and the next year of co-operative work might be devoted to testing, inspecting, methods analysis, or the like. The last year would be devoted to initial training in that department for which the student was aiming ultimately to qualify. Thus, in the course of a period of four years of co-operative training, the student would have the opportunity to acquire a substantial background in at least some of the functions of the factory administration. This progressive type of training is ordinarily obtained in the employ of one company. A change of company each year usually proves more a change of environment than a progression of experiences.

All types of enterprises employ Northeastern co-operative students. The limitation is determined by the interests and career objectives of the students enrolled at the time. They include engineering firms, manufacturing companies, public utilities, banks, railroads, insurance companies, wholesaling and retailing outlets, hospitals, social agencies, publishers and advertising houses, libraries, schools, development and research organizations, etc. Definite training schedules have been established with several of the co-operating companies. The ultimate objective of such schedules is absorption of the graduates into the permanent employ of the company, although such absorption is based on merit rather than guarantee.

Admission Requirements

Applicants for admission to the Freshman Class must qualify by graduation from an approved secondary school and must earn the recommendation of their principal or guidance counselor for the particular program to which they have applied. The most important single factor among the credentials submitted to the Committee on Admissions is the candidate's record of achievement in high school or preparatory school.

Application for Admission

A combined Application for Admission and School Record form may be obtained by writing to the Director of Admissions, or may be secured at the time of the admissions interview at the University. Directions for the proper use of these forms are included on the blank. The Application for Admission should be filled out in ink, properly signed, and forwarded with a non-returnable ten-dollar fee to the Director of Admissions, Northeastern University, Boston 15, Massachusetts. Checks should be made payable to Northeastern University.

Entrance Examinations

All candidates are required to write both the morning aptitude tests and the afternoon achievement tests of the College Entrance Examination Board. All applicants are required to write the English Composition achievement test. Two other achievement tests which you write will be determined by the particular college or program of studies to which you have applied. The following may be referred to as a guide:

Engineering	
Liberal Arts (Mathematics and Science)	{ Advanced Math. Physics or Chem. Inter. Math. or a science Choice of one
Education (the Teaching of Math and Science)	
Liberal Arts (Premedical, Predental, Biology, Premedical Technology, Psychology)	
Liberal Arts (Non-science fields)	
Business Administration	Choice of two
Education (Elementary Education, Soc. Studies)	

Applicants for admission should write the aptitude tests in December, January, or February. Normally, the achievement tests should be written in March. In some instances, however, they may be written in May. The earlier achievement testing date is preferred except for those students who are candidates for the second section of the Freshman Class which registers in November. You are advised to discuss with your guidance counselor plans for completing the College Entrance Examination Board testing requirement. There is a growing trend among high schools to encourage tests in the junior year. These tests results may be sent to the Admissions Committee for purposes of counseling and guidance if the applicant so wishes.

For full testing information and an application form, candidates may make arrangements through their schools or may write directly to this address:

College Entrance Examination Board
P. O. Box 592, Princeton, New Jersey

You should request the Board to send your scores on each set of examinations to Northeastern University.

College of Liberal Arts

The College of Liberal Arts offers three broad areas of study. Since the freshman year program is different in each of these areas, entrance requirements also vary.

All curricula:

<i>Subject</i>	<i>Units</i>
English (4 years)	3
Foreign language (2 years)	2
Mathematics (at least 1 year)	1
Science (at least 1 year)	1
Other college preparatory subjects	4
Electives, not more than	4
	<hr/> 15

The following curricula must include these mathematics and science units:

Biological science curricula (including Premedical, Predental, Premedical Technology, Biology)

Algebra, through quadratics, and Plane Geometry	3 units
Biology or Chemistry	1 unit

Science curricula (Physics, Chemistry, Mathematics)

Algebra, through quadratics; Plane Geometry and Trigonometry	3½ units
Physics	1 unit

College of Education

While secondary school students who complete a college preparatory program are, in general, preferred, admission to the College of Education is open to others as well. Important to the future teacher is high ability in the communication skills and adequate strength in the field of special interest. As important as the pattern and quality of an applicant's preparation are the personal qualifications which contribute to success in teaching.

All applicants are expected to have completed the following subject matter units:

<i>Subject</i>	<i>Units</i>
English (4 years)	3
Mathematics (at least 1 year)	1
Science (at least 1 year)	1
Other college preparatory subjects	6
Electives, not more than	4
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Students who wish to major in the teaching of mathematics and science must be able to present these mathematics and science units:

Algebra, through quadratics; Plane Geometry and Trigonometry	3½ units
Physics	1 unit

College of Business Administration

Preferred as applicants to the College of Business Administration are those students who are graduates of college preparatory programs of study. Other applicants may be admitted on the recommendation of their principals and guidance officers. The following subjects are, generally, prescribed as entrance requirements:

<i>Subject</i>	<i>Units</i>
English (4 years)	3
Mathematics	1
Science	1
College preparatory subjects	6
Electives	4
	<hr/>
	15

College of Engineering

It is important that applicants for admission to the College of Engineering complete successfully the full sequence of secondary school courses in English, Mathematics, and Science. The following subjects are required:

<i>Subject</i>	<i>Units</i>
English (4 years)	3
Physics	1
Algebra (through quadratics)	2
Plane Geometry and Trigonometry	1½
Other college preparatory subjects	5½
Electives	2
	<hr/>
	15

Other Requirements

Formal requirements are necessary and desirable in that they tend to provide all entering students with a common ground upon which the first year of the college curriculum can be based. But academic credits alone are not an adequate indication of a student's ability to profit by a college education. Consequently, the Department of Admissions takes into consideration a student's interests and aptitudes in so far as they can be determined, capacity for hard work, attitude toward classmates and teachers in high school, physical stamina and, most important of all, character. In this way the University seeks to select for its student body those who not only meet the academic admission requirements but who also give promise of acquitting themselves creditably in the rigorous program of training afforded by the Co-operative Plan and of becoming useful members of society.

Personal Interview

Effective guidance depends in large measure upon a complete knowledge of a student's background and problems. Although a personal interview is not required, except for scholarship applicants and those who apply for admission to the College of Education, applicants are cordially welcome to come to the University to discuss their educational plans. The Admissions Office, 150 Richards Hall, is open on Monday through Friday from 9:00 A.M. to 4:00 P.M. and on Saturday morning by appointment. Appointments for weekday interviews are made upon request.

Registration

Freshmen will register at the University on Wednesday, September 7, 1960, and Wednesday, November 16, 1960. Students are not considered to have met the requirements for admission until they have successfully passed the required physical examination. Registration must be in person.

Transfer or Advanced Standing

As a basic policy, students who wish to transfer to Northeastern in the same area of study, whether they seek credit or not, must have completed a satisfactory record in the institution in which they previously studied. Transfer students are admitted only in September or in November.

The Co-operative Plan makes transfer of credits difficult, since it is impossible to carry a combination schedule of freshman and upperclass subjects. A candidate for advanced standing should, therefore,

1. Have had courses which enable him to enter at the beginning of a year and thereafter continue as a regular student.
2. Have earned average grades or better in his previous college work. (No credit is given for the lowest passing mark.)
3. Have satisfactorily written recently the College Board examinations.

Persons who already have a bachelor's degree, regardless of their field of specialization, are not ordinarily accepted for admission as undergraduates.

Outline of Freshman Courses

The first year is a period of full-time study during which the student must demonstrate fitness for the program which has been elected. For students enrolled in the Colleges of Liberal Arts, Education, Business Administration, or Engineering, the Co-operative Plan of training on the job begins with the second year. Students who are unsuccessful in the basic courses of the freshman year will not be permitted to continue with their advanced program, but will be advised to change their goal and type of training. In some instances this will mean change to another curriculum at Northeastern; in others, withdrawal from the institution. *The freshman courses are so arranged as to permit change of objective during or at the end of the first year with a minimum loss of time.*

College Expenses

Tuition and Fees

Freshmen — The charge for tuition for all freshmen is \$250.00 per term, payable as indicated in the schedule below.

Engineering Upperclass Students — The charge for tuition for all Engineering upperclassmen is \$340.00 per regular term and \$170.00 per summer term.

Liberal Arts, Education, and Business Administration Upperclass Students — The charge for tuition for all Liberal Arts, Education, and Business Administration upperclassmen is \$300.00 per regular term and \$150.00 per summer term.

Student Teaching — The charge for student teaching in the College of Education is \$150.00.

Schedule of Tuition and Fee Payments, 1960-1961

FOR FRESHMEN

DIVISION S	Tuition and Fee	DIVISION N
September 7, 1960.....	\$250.....	November 16, 1960.....
November 21, 1960.....	250.....	January 30, 1961.....
January 30, 1961.....	250.....	April 10, 1961.....

The first term of the sophomore year, a five-week summer term, may be taken by Division S freshmen either in April immediately following the freshman year or in August, and by Division N freshmen either in June or August. Payments are due on the first day of the term in which the work is taken. Payment for tuition in this five-week term is one-half of Upper-class tuition for ten-week term.

FOR UPPERCLASSMEN (Co-operative Plan)

DIVISION A	Tuition and Fee Engineering	Tuition and Fee Liberal Arts, Education and Business Admin.
September 12, 1960.....	\$340.....	\$300
January 30, 1961.....	340.....	300
*August 7, 1961.....	170.....	150
DIVISION B		
November 21, 1960.....	\$340.....	\$300
April 10, 1961.....	340.....	300
*June 19, 1961.....	170.....	150
*Summer term (five weeks).		

FULL-TIME PLAN

Certain students in the Colleges of Liberal Arts and Education may elect non-co-operative full-time programs. Tuition rates are the same as for students on the Co-operative Plan, and payments are due on the corresponding dates.

Tuition Deposit

Applicants accepted for admission must upon request pay a nonreturnable tuition deposit of fifty dollars (\$50.00) as evidence of their intention to enroll, and this will be applied on their first tuition payment.

Payment of Tuition

All payments should be made at the Bursar's Office which is located on the second floor of Richards Hall. Checks should be made payable to Northeastern University. Students are not eligible to attend classes beginning with the second week of any term unless their tuition has been paid or specific arrangements have been made with the Registrar for a plan of deferred payment. Deferred payment of tuition entails a fee of two dollars.

Accident and Sickness Insurance

An excellent low cost accident and illness insurance covering "in-hospital" care is available to all Northeastern University students through a group insurance plan. The cost of this insurance is \$18.00 for the calendar year, payable in advance. *Students living away from home are required to participate in the plan;* commuters may do so if they wish. Circulars giving details of the insurance coverage will be sent to all candidates at the time their applications for admission to the University are accepted.

Chemical Laboratory Deposit

Freshmen taking chemistry make a Chemical Laboratory deposit of fifteen dollars (\$15.00) at the beginning of the year from which deductions are made for breakage, chemicals, and destruction of apparatus in the laboratory.

Upperclassmen taking chemistry or chemical engineering laboratory work make deposits at the beginning of each such term as follows:

Sophomores and Middlers.....	\$10.00
Juniors.....	20.00
Seniors.....	15.00

Reserve Officers' Training Corps — Uniform Deposit

Freshmen enrolling in ROTC make a deposit of ten dollars to cover loss of or damage to ROTC uniform and equipment. Any loss or damage exceeding the deposit will be charged to the student.

Application Fee

A fee of ten dollars (\$10.00) is required when the application for admission is filed. This fee is nonreturnable.

Late Registration Fee

A fee of \$5.00 will be charged for failure to register in accordance with prescribed regulations on the dates specified in the college registration bulletins. Registration must be made in person.

Graduation Fee

A fee of twenty dollars (\$20.00) covering graduation is required by the University of all candidates for a degree. This fee must be paid before the end of the fifth week of the last scholastic term in the senior year.

Estimated College Expenses for a Freshman

The following data, compiled from expense returns submitted by the student body, give an idea of freshman expenditures under ordinary conditions:

Application Fee.....	\$ 10.00
Tuition and Fees.....	750.00
Chemical Laboratory Deposit.....	15.00
Books and Supplies.....	60.00
Accident and Sickness Insurance (optional for commuters).....	18.00
ROTC Deposit (for those electing ROTC only).....	10.00
	<hr/>
	\$863.00

(Engineering students should add approximately \$50.00 for drawing instruments and equipment.)

Living Expenses Per Ten Week Term for a Freshman Residing in a University Dormitory

Room Rent } and Board }	\$240.00
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Students should allow an additional amount for clothing, incidentals and personal expenses. This amount will vary with individual tastes and spending habits.

Refunds

The University provides all instruction and accommodations on an academic term basis; therefore, *no refunds are granted except in cases where students are compelled to withdraw on account of personal illness or other reasons beyond their control.* A student must complete an official withdrawal application before being considered for refund. Questions regarding refunds should be discussed with the Dean of Students.

Financial Aid

Scholarships and Awards for Freshmen

Applicants who are interested in freshman scholarships are required to submit the Parents' Confidential Statement in support of their application for scholarship aid. This College Scholarship form is distributed by the secondary schools. It should be filled out by the parents or guardian of the applicant and mailed to the College Scholarship Service, Box 176, Princeton, New Jersey, not later

than February 15 of the current year. Scholarship applicants are expected to write the College Board Aptitude Tests in December or January and the Achievement Tests in March.

Trustee Scholarships

Established in 1928 by the Board of Trustees of Northeastern University. Each year the University grants in the four Day Colleges full and partial tuition scholarships to entering freshmen who have demonstrated throughout their preparatory or high school course superior scholastic attainment. For additional information relative to these scholarships, communicate with the Director of Admissions.

Regional Scholarships

Secondary school students who reside outside the normal commuting distance to Northeastern University, who have demonstrated superior achievement in their studies, and who are strongly endorsed by their principals and guidance officers, may qualify for a Regional Scholarship. Scholarships range in amount from \$700 to \$1200. Recipients are required to live in University sponsored residence halls. Interested students should request complete information and application forms from the Department of Admissions.

Scholarships for Women

In addition to the Trustee awards, certain special scholarships for young women entering the freshman classes are made available each year. These scholarships are awarded to well-qualified young women who expect to enter the Colleges of Liberal Arts, Education, Business Administration, and Engineering. High scholastic standing, evidence of leadership ability, and financial need are important considerations.

The Northeastern Faculty Wives Scholarship — each year the Faculty Wives Club of Northeastern University offers a half-tuition scholarship to a young woman of limited financial resources who has demonstrated a likelihood of succeeding in her chosen professional field.

Charles Hayden Memorial Scholarships

The Charles Hayden Foundation, created by the will of the late Charles Hayden, an alumnus of the Boston English High School, offers annually memorial scholarships to freshmen at Northeastern University. The scholarships are awarded to “deserving boys” whose parents are unable to finance the entire cost of their education. Full particulars concerning these scholarships may be obtained from the Director of Admissions of Northeastern University.

General Motors Scholarships

General Motors has a vital interest in higher education in America. Under its “College Plan” one four-year, full-time scholarship is granted to a high school senior of high ability who has been admitted to one of Northeastern’s Day Colleges. Under its “National Plan” high school seniors of exceptional promise who contemplate entering Northeastern are eligible to write the competitive examination of the Educational Testing Service, Princeton, New Jersey. Winners are awarded four-year scholarships for study in the fields of their choice. Full par-

ticulars concerning these scholarships may be obtained from your high school guidance counselor or by writing to the Northeastern University Director of Admissions.

Henry B. Alvord Memorial Scholarship in Civil Engineering

Established in 1940 in memory of the late Henry B. Alvord, Professor of Civil Engineering and Chairman of the Department for eighteen years. The award is made annually to a student graduating from an accredited secondary school who has demonstrated superior academic ability and gives promise of succeeding in civil engineering. The grant of two hundred and fifty dollars is made only to an entering freshman who is qualified for and plans to study civil engineering.

The M.K.M. Scholarships

Established in 1953. The M.K.M. Knitting Mills, Incorporated, Manchester, New Hampshire, offers annually two scholarships in the amount of \$250.00 each to employees of the Company, to sons and daughters of employees, and to high school seniors residing in Hillsboro County, New Hampshire. Scholarship recipients will be expected to complete at least three work periods with M.K.M. Knitting Mills, Inc., or one of its subsidiaries. The purpose of these scholarships is to provide an opportunity for qualified students to further their education in the fields of Mechanical Engineering or Business Administration, and to help prepare these students for supervisory and executive positions in the knitting industry.

The Sheffield Corporation Scholarships

Established in 1953. The Sheffield Corporation of Dayton, Ohio, offers annually a number of Northeastern University scholarships to employees of the Company and its subsidiaries, sons and daughters of employees, and high school seniors residing in Franklin County, Massachusetts. Each scholarship is in the amount of \$1,200.00. Recipients are expected to complete at least three work periods with the Threadwell Tap and Die Company in Greenfield, Massachusetts. The purpose of the Sheffield Scholarship Plan is to provide an opportunity for young men and women to further their education in the fields of Mechanical and Industrial Engineering and to train them for positions in the precision tool and gauge manufacturing industry.

National Defense Act Student Loans

National Defense Act Student Loan Funds are now available to qualified incoming freshmen. Applicants are required to show evidence of financial need and must follow the usual procedure of submitting the Parents' Confidential Statement to the College Scholarship Service, Princeton, New Jersey. High School seniors may receive full information from their guidance counselors.

Scholarships, Prizes, and Awards for Upperclassmen

Students in classes above the freshman year may apply for financial aid to the Director of Financial Aid for Students. All scholarship applicants are required to give evidence of financial need.

Prizes and awards are determined by appropriate committees usually headed by the Dean of Students. Financial need is not a requirement, and students do not apply for prizes and awards.

President's Awards

Established in 1929. Annually in each division at the Dean's List Dinners four scholarships of one hundred dollars each, known as the President's Awards, are presented to the students with the outstanding records in the sophomore, middler, junior and senior classes. The scholarships are accompanied by a congratulatory letter from the President.

Sears B. Condit Honor Awards

Established in 1940 through the generosity of Sears B. Condit. In the fall of the year at a University convocation Sears B. Condit Honor Awards, not less than twenty in number, are awarded annually to outstanding students in the upper three classes of the College of Liberal Arts, the College of Education, the College of Business Administration, and the College of Engineering. Each award carries a stipend of not less than one hundred dollars as well as a certificate of achievement.

Tau Beta Pi Award

Massachusetts Epsilon Chapter of Tau Beta Pi Association, national honorary society in engineering, offers annually a scholarship of one hundred dollars to the sophomore in the College of Engineering who, during the previous year as a freshman, made the highest scholastic record.

The Sigma Society Award

The Sigma Society, the honorary society of the College of Business Administration, offers annually a scholarship of one hundred dollars to the sophomore in the College of Business Administration who, during the previous year as a freshman, made the highest scholastic record.

The Academy Award

The Academy, the honor society of the College of Liberal Arts, offers annually a scholarship of one hundred dollars to the sophomore in the College of Liberal Arts who, during the previous year as a freshman, made the highest scholastic record.

Woman of the Year Award

The Omega Sigma Society sponsors annually a scholarship of one hundred dollars to the senior woman student who, by high scholastic attainment and by demonstration of the quality of leadership, has proven herself the outstanding woman student of the year.

Alumni Awards for Professional Promise

Established in 1947 by the Alumni Association of the Day Colleges. These awards are presented annually at the University convocation sponsored by the Alumni of the Day Colleges. The awards are made to the outstanding seniors in each of the four Day Colleges who have demonstrated unusual professional promise through their character traits, scholastic achievement, and co-operative work performance.

ROTC Scholarships and Awards

Scholarship awards totaling \$975 are available to ROTC cadets each year. The University offers nine \$50 scholarships annually. They are: one to the outstanding freshman cadet, four to sophomores (one in each branch and division), two to middlers (one to each branch), and two to juniors (one to each branch). Scabbard and Blade (the cadet officers' honorary society) offers four \$125 scholarships annually to middlers. The Pershing Rifles (the basic course honorary society) offers a \$50 scholarship to a sophomore Pershing Rifles cadet.

Academic Achievement Awards are won by each cadet in the top ten per cent of ROTC classes. This award, an embroidered wreath, is worn on the right sleeve of the uniform during the year immediately following. Leadership Achievement Awards, consisting of letters of commendation, are awarded to each cadet in the top ten per cent in leadership potential.

Many medals and trophies are also awarded by other organizations to ROTC cadets for achievement in diverse fields.

Boston Society of Civil Engineers Scholarship in Memory of Desmond FitzGerald

Established in 1931 by the Boston Society of Civil Engineers in memory of Desmond FitzGerald, a former president of the Society and an eminent hydraulic engineer with a distinguished record of service. It has been awarded annually since 1931 to an outstanding Northeastern University senior or junior student in the Department of Civil Engineering of the College of Engineering. The presentation is made by the President of the Boston Society of Civil Engineers at a College of Engineering convocation in the spring of the year.

William J. Alcott Memorial Award

Established in 1934 by members of the faculty and other friends to perpetuate the memory of William Jefferson Alcott, Jr., a brilliant member of the Department of Mathematics in Northeastern University from 1924 until his death in 1933. The award is made annually from the income of the fund for outstanding scholastic achievement during the preceding year, either in a particular field of interest or for a superior academic record.

William Lincoln Smith Scholarship Fund

Established in 1947 by Farnham Wheeler Smith, Class of 1924, Benjamin Lincoln Smith, Class of 1923, Thomas Hollis, Jr., Class of 1941, and other members of the family in honor of Dr. William Lincoln Smith who served long, faithfully, and with distinction as chairman of the Department of Electrical Engineering at Northeastern University. The income from the fund is to be used for an annual scholarship award to a student enrolled in the Department of Electrical Engineering who has demonstrated excellence in some aspect of electrical research or who stands high in his courses or who otherwise exhibits promise of future competence in the field. The award shall preferably be granted to a student who needs financial assistance to continue his college work.

Clara and Joseph F. Ford Scholarship

Established in 1947 by friends and employees of Clara and Joseph F. Ford to provide tuition scholarships for worthy, needy, and well-qualified students who have demonstrated a democratic and tolerant spirit and who are well disposed toward people of all creeds and races.

The Henry Francis Barrows Scholarships

Established in 1949, the Henry Francis Barrows Scholarships at Northeastern University, provided under the will of Fanny B. Reed, offer Protestant young men, born and brought up in New England, four scholarships of \$250.00 each. Good scholastic standing, good character, and need must be demonstrated by recipients of the scholarships.

Blonder-Tongue Foundation Scholarship Award

Established in 1957. The Blonder-Tongue Foundation, supported by Blonder-Tongue Laboratories, Incorporated, has established an annual scholarship of \$250.00. This scholarship will be awarded to a junior or senior student in recognition of high scholastic attainment and demonstration of outstanding potential in the field of electronics. The character and financial need of the student shall be considered in determining the recipient each year. Other factors being equal, preference shall be given to a member of the senior class. This scholarship award will be made during the latter half of the academic year by the Dean of Students with the advice and counsel of the Department of Electrical Engineering.

Roland Guyer Porter Memorial Fund

This fund was established in 1953 by colleagues and friends of the late Professor Roland G. Porter, for many years Head of the Department of Electrical Engineering. Interest on the fund provides an annual award to a student in the Department of Electrical Engineering who best exemplifies the qualities of mind and character which Professor Porter did so much to develop in his lifetime.

The Mr. and Mrs. Emil Matthew Bauer Fund

Established in 1954. The interest of the fund is to be used for granting scholarships or other financial assistance to students of German birth or of German extraction for studies at Northeastern University. The scholarships are available to either men or women students enrolled in any year of the University.

Westinghouse Achievement Scholarship in Electrical Engineering

Established in 1954. This annual scholarship of \$500.00 per year is to be awarded to a junior in Electrical Engineering on the basis of high achievement in his academic work and demonstrated qualities of leadership. The recipient will

be selected by a committee of the faculty. The scholarship is paid in two installments of \$250.00 at the beginning of the first and second semester of the student's senior year.

The Harold D. Hodgkinson Achievement Award

Established in 1954. The Harold D. Hodgkinson Achievement Award of \$400.00 is granted annually to a junior student for his senior year. The winner of the award is known as the Hodgkinson Scholar for the year in which he is chosen. The award is based primarily upon distinguished scholastic achievement with due consideration of character, personality, qualities of leadership, co-operative work experience, military record, if any, and service in voluntary organizations and activities. Student leadership accomplishments and professional potential are evaluated in connection with these criteria. Other qualifications being equal, a relative of the donor or a candidate connected with Filene's by co-operative work or relationship is given preference. The Hodgkinson Scholar is chosen by a committee of administrative members of the faculty. An appropriate certificate is presented to the recipient as a permanent record of his selection.

Columbian National Life Insurance Company Scholarship

Established in 1956 by the Columbian National Life Insurance Company as an incentive for students majoring in the field of mathematics who are interested in the possibility of a career in the actuarial field. This scholarship, of up to \$500.00, will be given annually to an outstanding young man or woman who will be judged on scholastic achievement, leadership potential, financial need, as well as career objective. The amount of the grant will be determined by the Committee on Scholarships of the University.

Avrom Aaron Leve Memorial Scholarship

Established in 1957 in memory of Dr. Avrom Aaron Leve, former Assistant Professor of Psychology. The interest of the fund will be used annually to provide scholarships to be awarded to upperclass students majoring in the field of psychology. The award will be made on the basis of academic achievement, financial need, and character.

United States Rubber Company Foundation Scholarships

The United States Rubber Company Foundation has established scholarships to be awarded to students in the Colleges of Engineering, Business Administration, and Liberal Arts who qualify on the basis of academic performance and potential, need for financial assistance, demonstration of interest for a career in industry, and leadership and character. Recipients assume a moral obligation to repay at least 25% of any scholarships received to the University Scholarship Fund after graduation. Students must have completed at least two years of their undergraduate program. Further information regarding these scholarships may be obtained from the Dean of Students Office.

Gardner A. Caverly Scholarship Fund

Established in 1957. Qualified students will be selected in the following order of preference:

1. Son or daughter must be an employee of the Rutland (Vermont) Railway Corporation.
2. A graduate of Rutland, Vermont High School.
3. A graduate of the Laconia, N. H. High School.
4. A graduate of any high school in New England.

Frank B. Sanborn Scholarship Fund

Established in 1958. The Frank B. Sanborn Scholarship Fund was established to provide a scholarship or scholarships of not more than \$500.00, to worthy and needy students, as selected by the University, without restrictions as to race, creed, or geographic origin, but with preference to students in the following order: Electrical, Mechanical, Civil, and Industrial Engineering.

Each recipient must be willing to assume a moral obligation to reimburse the fund as he may be able to, in order to make similar financial aid available for other students in later years. There shall be no interest charged nor time specified for reimbursement.

J. M. Rosen Scholarship

Established in 1958. A scholarship of \$400.00 to be granted to a student or students in the Colleges of Engineering, Business Administration, Liberal Arts, or Education, with due regard for need and capacity to profit by attendance at college but without restrictions as to race, creed, or geographic origin.

*Electrical Manufacturers Representatives Club
of New England Inc., Scholarship*

Established in 1958. A scholarship of \$475.00 to be granted to a student or students majoring in electrical engineering, without regard to race, creed, or color. To qualify, students must have real financial need and excellent scholastic standing.

Ruth E. Phalen Memorial Award Fund

Established in 1959 by Thomas E. Phalen, Jr., a member of the faculty, in memory of his wife. The income of this fund will be used yearly as a cash award to a senior, junior, or middler, preferably in the College of Engineering, who maintains at least a 2.0 academic average, shows outstanding ability in one or more varsity sports, and demonstrates excellent campus citizenship.

Harold A. Mock Award

Established in 1959 by Harold A. Mock, a distinguished alumnus of the University. An annual award of \$200.00 will be made to an outstanding member of the junior class in the College of Business Administration. The Committee on scholarships will choose the recipient on the basis of high academic standing and co-operative work achievement, participation in University extracurricular activities, personality and character.

The New England Paper Merchants, Inc., Scholarship

Established in 1959 by the New England Paper Merchants Association, Inc. An annual scholarship of \$150 to be awarded to a student in the College of Business Administration for his junior or senior year, who has demonstrated by his Co-operative Work achievement and his extracurricular activities an interest and potential in the field of sales. The recipient shall also be a student who has financial need, a substantial academic record, and high character.

Loan Funds

Student Loan Fund

The University has established a revolving loan fund to assist students who are faced with unexpected financial problems in meeting their tuition payments. Loans to meet tuition and to be repaid after graduation may be arranged when unforeseen emergencies arise. Further information may be obtained from the Director of Financial Aid for Students in the Dean of Students Office.

Jewish Vocational Aid Society

The Jewish Vocational Aid Society has established a \$1,000.00 revolving scholarship loan fund for Northeastern University to assist deserving and needy students. This fund is to be used for both men and women, regardless of creed or racial origin, residing in the Greater Boston area and for vocational study.

Loans are not to exceed \$300.00 in any one school year. Recipients will be required to sign notes to repay, after graduation, amounts granted without interest. Applications must be made directly to the Society.

National Defense Student Loan Program

Any student in good standing who can demonstrate financial need is eligible to apply to the Director of Financial Aid for Students for assistance under this program. Special consideration will be given to superior students in Education, Engineering, and in Liberal Arts for Science, Mathematics, and Foreign Language majors. Loans to borrowers who teach in elementary and secondary schools after graduation will be canceled up to a maximum of 50 per cent at the rate of 10 per cent for each year of such teaching. No interest is charged on loans until one year after graduation; after that 3 per cent is charged. Borrowers may have up to 10 years to repay.

Higher Education Loan Plan {HELP}

The Massachusetts Higher Education Assistance Corporation was chartered in 1956 by the Massachusetts legislature to aid young men and women of Massachusetts to complete their programs of higher education. Students who are domiciled in Massachusetts and who have satisfactorily completed the freshman year are eligible for HELP loans. Ordinarily, HELP loans will be limited to \$500.00 in any one academic year, with an overall limitation of \$1500.00. Further information and application blanks may be obtained from any commercial bank in Massachusetts.

Further information and applications pertaining to scholarships listed above may be obtained from Dean of Students Office in Richards Hall.

Student Activities

Northeastern University regards student activities as an integral part of its educational program. One of the main departments of the University, the Student Activities Department is charged with the responsibility of co-ordinating the various types of activities and of administering the social, musical, literary, and athletic organizations in such a way as to enable each to contribute in a wholesome, worthwhile manner to student life at Northeastern. Every student is encouraged to participate in such activities as may appeal to him.

Members of the faculty also are interested in extracurricular activities. A faculty adviser is appointed for each student organization. His function is to encourage the students in the development of their programs, and to give them the benefit of his experience and mature point of view in integrating these programs with other important phases of college life.

One of the outstanding contributions of the Co-operative Plan in the field of higher education has been its capacity to develop in students those powers of social understanding that are so essential to success in professional life. At Northeastern the program of student activities is made to contribute to this end in a very real way. It is a conscious aim of the student activities advisers to develop among their advisees those qualities of personality and character which will enhance their usefulness as future professional men and citizens. Students have splendid opportunities to develop administrative and executive ability as leaders of undergraduate organizations. No academic credit is awarded for any student activity. This has been no deterrent, however, to student participation in extra-curricular activities, for a substantial majority of the undergraduate body participates annually in one or more forms of student activity.

Athletics

The University maintains both varsity and freshman teams in baseball, basketball, cross-country, football, hockey, and track. Games and meets are arranged with many eastern colleges. A well-rounded program of intramural sports is available for men students and a program of intramural sports and dance is offered to women students. The girls also play basketball with girls from other colleges in the Boston area.

Athletic policies for the University are determined by the Faculty Committee on Student Activities. This committee determines the eligibility of students to participate in athletics, approves the various sports schedules, and approves awards of letters and numerals to qualified athletes.

Honor Societies

Six honorary societies are chartered in the colleges:

Tau Beta Pi, in the College of Engineering (Massachusetts Epsilon Chapter).

Eta Kappa Nu, in the Department of Electrical Engineering (Gamma Beta Chapter).

Pi Tau Sigma, in the Department of Mechanical Engineering (Northeastern Tau Kappa Chapter).

Phi Alpha Theta, in the College of Liberal Arts, History Department (Northeastern Zeta Tau Chapter).

The Sigma Society, in the College of Business Administration.

The Academy, in the College of Liberal Arts.

Election to the college honorary societies is based primarily upon scholarship but, before a man or woman is privileged to wear the honorary society insignia, there must be evidence of an integrity of character and an interest in the extra-curricular life of the University as well as an acceptable personality. The societies have memberships consisting of the outstanding men and women in the colleges. Election to an honorary society is the highest honor that can be conferred upon an undergraduate.

Publications

"The News" — A college newspaper, the *Northeastern News*, is published each week throughout the college year by a staff selected from the student body. The copy is prepared, edited, and published by the students themselves with the counsel of a faculty adviser. Opportunity is afforded for the students to express their opinions on subjects relating to study, co-operative work, social events, or topics of the day. Positions on the *News* staff and promotions are attained by competitive work. The paper is in part supported by advertising, both national and local, and in part by a portion of the student activities fees. The *Northeastern News* is a member of the Eastern Intercollegiate Newspaper Association and sends one of its editors to the annual convention of this association each year. Copies of the *News* are mailed to upperclassmen when they are at co-operative work and to freshmen after the close of their college year.

"The NUWriter" — A literary magazine whose editors select for publication the best examples of creative writing submitted by the student body.

"The Cauldron" — The combined senior class publishes annually a college year-book, *The Cauldron*. It is distributed without charge to the seniors and contains a complete review of the college year with class histories, pictures of all seniors, of the faculty, and of undergraduate groups, as well as a miscellany of snapshots and drawings contributed by students.

Student Council

Student government of the Colleges at Northeastern University is vested in the Student Council, composed of elected representatives from the various classes. The Council is the authority on all matters relating to student policies not definitely connected with classroom procedure. It has jurisdiction, subject to faculty approval, over all such matters as customs, privileges, and campus regulations.

Student Union

The purpose of the Northeastern Student Union is to deepen the spiritual lives of Northeastern men and women through the building of character, to create and promote a strong and effective Northeastern University spirit in and through a unified student body, to promote sociability, and to emphasize certain ethical, social, civic, intellectual, and avocational values.

All students are encouraged to participate in the activities of the Union, no matter what their religious faith, as the work of the Union is entirely nonsectarian.

The Chapel Committee assists the Dean of Chapel and Director of Music in conducting the voluntary and interfaith services held on Wednesdays from

8:20 A.M. to 8:45 A.M. in the Bacon Memorial Chapel. This committee also has charge of special chapel programs at the Christmas and Easter seasons.

Professional Societies and Clubs

To assist in the promotion of social, cultural, and intellectual advancement through informal channels, many professional societies and clubs are sponsored. The following partial list is given to indicate the variety of opportunities available:

Accounting Society — All students interested in accounting are invited to become members of this club. Problems involving accounting are presented and discussed at club meetings. Upperclassmen present problems arising out of thesis or co-operative work experience, and able practitioners from the professional world are invited to present papers and lead the student discussions.

Advertising Society — Affiliated with the Junior Advertising Club of Boston and with the National Industrial Advertisers' Association through the Technical Advertising Association of Boston, this Student Chapter is committed to the development of professional associations and interests among its members.

American Finance Association (N.U. Student Chapter) — The purpose of this society is to increase knowledge of the investment field by providing opportunities for discussions and by arranging for supplementary talks by outstanding personalities in the professional world of finance. All interested students are welcome at the meetings, which are held regularly during each ten-week term.

The Armed Forces Communications and Electronics Association (AFCEA) — This is a national professional society composed of the leaders of industry and of the departments of the Armed Forces concerned with communications, electronics, and photography. It is sponsored by the Signal Corps Branch of ROTC. Membership is open to any student who is interested in communications, electronics, and photography. They take many field trips and have prominent speakers at regular meetings.

Art Club — The Art Club is open to all Northeastern students interested in sketching or painting. Weekly meetings are organized to provide instruction and guidance in pencil and charcoal sketching, water coloring, and oil painting. The regular program includes several field trips for practice in sketching or painting seascapes and landscapes. Several exhibitions of the work of members are held during the year.

Auto Club — The Auto Club runs special programs for sports car and antique auto enthusiasts.

Biology Club — The Biology Club (Nu-Beta) serves to stimulate interest in the biological sciences by presentations of motion picture films, lectures, and field trips. Membership is open to all students without restriction.

Camera Club — The Camera Club welcomes all men and women interested in photography. Weekly discussions and special evening lectures by guest artists are part of the yearly program. Field trips, monthly photo contests, and a general exhibition add to the interest and progressive work of this organization.

Chemistry Society — The Chemistry Society is a student affiliate chapter of the American Chemical Society. Membership is open to upperclassmen majoring in chemistry or chemical engineering. Meetings are held twice during each term, at which times talks and motion pictures are given on various chemical subjects.

Chess Club — The Chess Club gives both beginners and experts an opportunity to enjoy the game. Yearly tournaments are held among the members and from time to time the Club engages in intercollegiate competition.

Debating Society — The purpose of the Debating Society is "to foster and promote an interest and facility in formal argumentation; to develop an impartial, unbiased, and intellectual consideration of questions and issues of current interest; and to sponsor intercollegiate relationships and competition in the debating field." Membership is open to all students of the colleges.

Dramatic Club — The Silver Masque affords an opportunity for those students interested in dramatics to participate in the production of several pieces in the course of the college year. Qualification for the cast and for positions on the business staff is through competition under the direction of the faculty adviser.

Student N. E. A. — A professional association for college students actively preparing to teach. Its aim is to provide experiences which help develop professional awareness and competency and assist in guiding students into proper areas of specialization.

Engineering Societies, National — Students in the several professional curricula of the College of Engineering operate Northeastern University Sections of the appropriate national professional societies. Chief among these are the following:

- American Society of Civil Engineers
- Boston Society of Civil Engineers
- American Society of Mechanical Engineers
- American Institute of Electrical Engineers
- American Institute of Chemical Engineers
- American Institute of Industrial Engineers
- Society of Women Engineers

Members of the engineering faculty who hold membership in the parent organizations serve as advisers to these student groups. Meetings are held regularly and practicing engineers are invited to address the sections. Occasionally appropriate motion pictures are shown or the group visits some current engineering project in the vicinity of Boston. The College of Engineering encourages these student sections of the technical societies in the belief that they provide a wholesome medium for social intercourse as well as a worthwhile introduction to professional life.

Husky Key — This organization for the promotion of school spirit provides special services at athletic events and for visiting teams and other groups.

Hus-Skiers — The purpose of the Hus-Skiers is to hold an integrated program of ski activity, including weekend outings during the winter season. A tournament and carnival are held near the close of the season in which all members are eligible to take part. The club holds charter membership in the New England Intercollegiate Ski Conference. Skiing is recognized as a minor sport.

International Relations Club — The International Relations Club was founded for the purpose of studying and discussing those current national and international events and issues which vitally concern our American life and institutions. The club maintains contacts with similar organizations in other colleges.

Jazz Society — This group is primarily interested in contemporary American music and sponsors festivals, small “live” concerts, speakers, and recent recordings.

Marketing Association — Students in the College of Business Administration maintain a student chapter of the American Marketing Association for the purpose of enhancing the professional development of its members. Meetings are held each ten-week period at which executives from Greater Boston firms discuss current issues in the field.

Mathematics Club — The Mathematics Club encourages the study of topics of mathematical interest which are either outside or beyond the scope of the regular mathematics courses.

Military Affiliated Radio System (MARS) — This activity, known as MARS, is a world-wide organization of amateur radio operators, sponsored by the U. S. Army Signal Corps. It operates station AAIWAS at Northeastern University. Membership is open to all “ham” operators who have or desire to obtain amateur licenses. It co-operates with the Radio Club.

ROTC Flight Training Program — ROTC Flight Training is offered to physically qualified, specially selected cadets enrolled in MS IV. Cadets are given training in the basic principles of “contact flying” and successful completion of the program leads to a Civil Aeronautics Administration private pilot’s certificate.

Musical Clubs — The Department of Student Activities sponsors musical clubs, such as the following: concert orchestra, band, chorus, and dance orchestra, for which all students with musical ability are eligible. Membership in the various musical clubs is attained by competitive effort.

Women’s Societies — The social activities for women are centered in two societies, Omega Sigma and Gamma Delta. Each society has its own program of banquets, teas, informal parties, general meetings, and social service projects. The societies co-sponsor activities such as a mid-winter dance. One of the primary objectives of the societies is to offer the women students at Northeastern University opportunity for closer friendship, for spirited participation in wholesome activity, and for leadership development.

Pershing Rifles — This is an honorary society open to ROTC freshmen and sophomore cadets who distinguish themselves. The national society was founded in 1894 at the University of Nebraska and now has about 130 chapters at colleges and universities throughout the country. Company A, 12th Regiment, at Northeastern University was chartered in 1952. It encourages, promotes, and develops citizenship and the highest ideals of the military profession. The Rifles have a crack drill team that participates at University and local civil ceremonies.

Student Section of the American Institute of Physics — Membership is open to all students having physics as one of their primary interests. Meetings are held regularly. The program consists of student and guest speakers, demonstrations, films, and tours through local centers of research.

Politics Club — This club provides students with opportunities to become better acquainted with current political issues and to hear outstanding speakers from the national and state political organizations.

Psychology Society — An organization in which interests in technical psychology are pursued. The membership is open principally to majors in the field of psychology, but this does not preclude from participation any or all students who have an active interest in psychology.

Radio Club — One of the most popular undergraduate activities is the Radio Club. Members are provided opportunity for code practice and are encouraged to obtain their amateur licenses. The club owns and operates station W1KBN, a short-wave transmitter, located in the Radio Laboratory in the penthouse of Hayden Hall. Meetings are held about once a month for the discussion of technical matters. Practicing radio engineers are frequently invited to address the club at evening meetings, when students in both divisions may attend.

Rifle Club — Recognized as a minor sport, the club offers opportunities for intercollegiate competition on the varsity level, as well as intramural matches for various club teams. ROTC cadets participate in Army area matches and the women's rifle team in National Rifle Association competition.

Scabbard and Blade — This is the ROTC cadet officers' honorary society. The National society was founded in 1905 at the University of Wisconsin and there now are over 128 chapters at colleges and universities throughout the United States. Company H, 11th Regiment, at Northeastern was chartered in 1954. Membership is restricted to advanced course cadets and is by invitation only. Scabbard and Blade is the most important ROTC activity because of its high standards of performance and fellowship. Its membership furnishes the key cadet officers in the Corps. It sponsors the Annual Military Ball.

The Society of American Military Engineers (SAME) — This is a national professional society composed of civilian industrial leaders and officers of the Armed Forces concerned with military and industrial construction and military engineering. Membership is open to all engineering students. It is sponsored by the Corps of Engineers Branch of ROTC. They take many field trips and have prominent speakers at regular meetings.

Sociology Society — This organization provides an opportunity for sociology majors, as well as interested students from other fields, to join with faculty members of the department to explore matters of common concern that pertain to the field.

Society for Advancement of Management (N. U. Student Chapter) — The purposes of this professional society are to stimulate student interest in the profession of management and to present to the student a picture of management problems and functions through lectures, plant visitations, group discussions, and the like. Membership is open to all upperclassmen interested in the profession of management. The N. U. Student Chapter is sponsored by the Boston Chapter of S.A.M.

University Band — Open to all students with musical ability, it performs at University events such as convocations, football, basketball, and hockey games, and at parades and ROTC reviews.

Yacht Club — The Yacht Club is a member of the Intercollegiate Yacht Racing Association. The club participates in regattas held in the Charles River Basin and also in regattas held at other colleges. Sailing is recognized as a minor sport.

Class Organization and Activity

Each of the classes in the Day Colleges elects its officers and carries on activities as a class. Dances are sponsored by the classes at regular periods throughout the year. One of the highlights of the social program is the Junior Promenade, held each spring at one of the Boston hotels.

Senior Week is the culmination of five years of class activities. Informal dances, beach outings, a moonlight cruise, and the formal Senior Promenade are held during the week prior to Commencement.

Convocations

These meetings are normally held in Symphony Hall. There will be a President's Convocation for Freshmen during the Orientation Period. Meetings for the entire University, known as the Fall Convocation and the Honors Convocation, are held during the year on Wednesdays from 12-1, and bring before the student body some of the ablest and foremost leaders of our country. Attendance is compulsory. Other convocations may be announced during the year. These meetings are under the direction of the Dean of Students Office.

Nonsectarian Chapel Services

The period from 8:20 to 8:45 on Wednesdays throughout the year is reserved by the University for nonsectarian chapel services. Northeastern was founded upon inclusive and broad religious principles, and spiritual values are regarded as indispensable to good citizenship. Attendance at chapel services is therefore encouraged though not required.

The Bacon Memorial Chapel is located in the Ell Student Center. Adjoining it the Dean of Chapel has his office, where he is available to all students upon appointment.

For over three decades eminent leaders of religion — ministers, priests, and rabbis alike — have participated in this interfaith service. A Chapel choir is led by the director of music, and students of various religious backgrounds assist in the order of worship.

The Northeastern Chapel program enjoys the distinction of having recognition through charter membership in the National Association of College and University Chaplains.

Fraternities

There are at present nine local Greek letter fraternities chartered by Northeastern University. Each fraternity is provided with a faculty adviser who is responsible for the proper administration of the fraternity house under the rules and regulations established by the faculty. The list of fraternities in the order of their establishment is as follows:

- | | | |
|-----------------------|--------------------|--------------------|
| 1. Beta Gamma Epsilon | 4. Sigma Kappa Psi | 7. Sigma Phi Alpha |
| 2. Alpha Kappa Sigma | 5. Phi Beta Alpha | 8. Kappa Zeta Phi |
| 3. Nu Epsilon Zeta | 6. Phi Gamma Pi | 9. Gamma Phi Kappa |

Elected representatives from each fraternity make up an Inter-Fraternity Council, a body which has preliminary jurisdiction over fraternity regulations. Its rulings are subject to the approval of the Faculty Committee on Student Activities.

Reserve Officers' Training Corps

General Objectives

The Department of Military Science and Tactics is the instructional department of the Colleges which administers the Reserve Officers' Training Corps Program (ROTC) and conducts instruction in Military Science and Tactics. The Reserve Officers' Training Corps is regarded by Northeastern University as an integral part of its educational program, and the aim is to make ROTC available on a voluntary basis to all male undergraduate students of the Colleges who are otherwise qualified. The University believes that the leadership, citizenship, and other military training available to students taking ROTC is beneficial in their overall development as future leaders and, therefore, encourages enrollment. The courses outlined in this section, accordingly, are available to students in all colleges of the University.

The Reserve Officers' Training Corps of the United States Army exists for the purpose of developing officers — leaders of men. It offers courses of instruction leading to a commission as a second lieutenant in the United States Army Reserve or the Regular Army. The mission of ROTC is to have ready in time of national emergency a corps of educated, trained leaders for our nation. The Northeastern ROTC is an Army, Senior Division, Class CC (Civilian College) unit with branches in the Corps of Engineers and Signal Corps. Enrollment in ROTC is entirely voluntary.

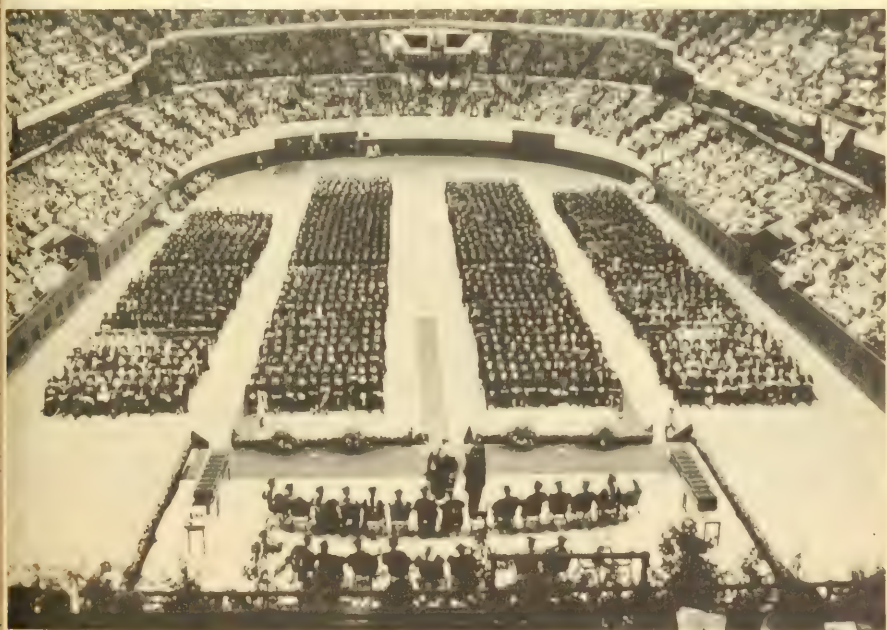
The greatest benefit to the individual from ROTC training is its development of leadership qualities. Leadership — the ability to organize and direct the activities of others — is in high demand by business, industry, the social fields, the military service — almost all human enterprises.

Although the Department of Military Science and Tactics is an instructional department of the Colleges, it is also interested in many extracurricular student activities as part of its overall leadership development program. There exists, therefore, close association with the Department of Student Activities, and activities associated with ROTC (listed under "Professional Societies and Clubs") have Army officers assigned by the University as Faculty Advisers. Also, ROTC students who gain positions of leadership on the campus in activities not directly associated with ROTC, such as publications, dramatics, athletics, or student government, have thereby displayed leadership achievements which are valuable in ROTC training and which can be recognized in ROTC leadership potential ratings. The overall progress of a student in the University, as well as his military progress, is always considered in ROTC training. Among the ROTC activities, the Annual Military Ball is one of the most colorful campus events of the year. The Fall Awards Ceremony in honor of the University President, at which he presents ROTC scholarships and the Spring Awards Ceremony, at which Distinguished Military Student badges and other awards are presented by University officials and representatives of donor societies, also are colorful events open to the entire "University Family."

The staff and faculty of the Department of Military Science and Tactics consist of officers, noncommissioned officers, and civilians, assigned to Northeastern University by the Department of the Army, and of civilians furnished by the University. All military members are especially selected because of professional



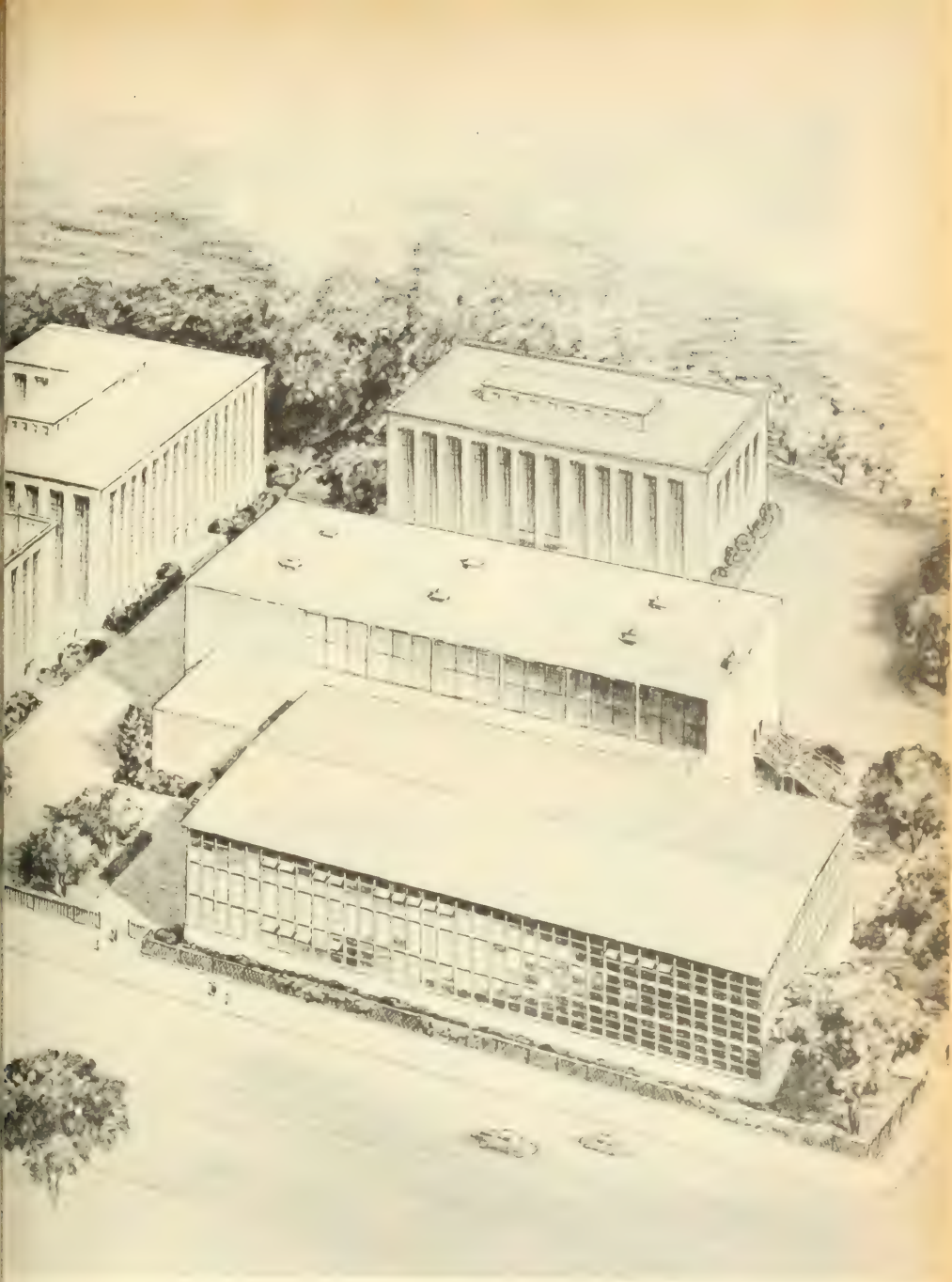
Instructor and student in the Advertising Laboratory



Commencement in the Boston Garden

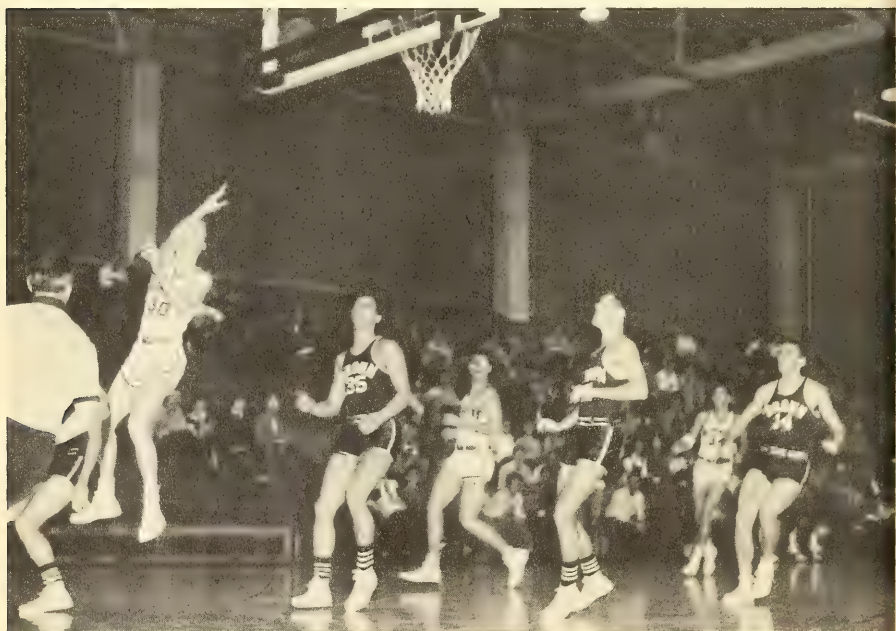


The Huntington Avenue Development as seen by the Architect





The Husky Highlighters bring news of the day



Northeastern's Varsity basketball team in one of its many intercollegiate contests

competence, educational background, and ability to fit into the "University Family." Officers are individually nominated for assignment to the University and are assigned only after records have been reviewed and each individually has been accepted by the University.

The Department Chairman and Professor of Military Science and Tactics is a United States Army officer whose appointment has been mutually agreed upon by the University President and the Department of the Army.

Courses of Study

The program of instruction consists of a basic course and an advanced course, presented in two branches of the United States Army, Corps of Engineers and Signal Corps. Only Army ROTC is available at Northeastern. The basic course (MS I & MS II) requires three hours of instruction per week during the freshman year and four hours during the sophomore year. The Corps of Engineers limits its ROTC to students enrolled in engineering courses, but the Signal Corps, while especially desiring electrical and other engineering students, also accepts non-technical students for ROTC. There are many command, administrative, personnel, business management, and other position openings in the Signal Corps for non-technical college graduates. At Northeastern, students majoring in Civil, Mechanical, and Industrial Engineering are enrolled for Corps of Engineers instruction, while those majoring in Electrical and Chemical Engineering and all non-engineering majors in the Colleges of Business Administration, Education, and Liberal Arts are enrolled for Signal Corps instruction.

The basic course includes instruction common to all branches of the Army. Students completing the basic course are awarded a "Military Training Certificate" as evidence of successful completion of this course. This certificate indicates one's patriotic accomplishments and has positive value in many ways. Branch instruction starts with the advanced course for Corps of Engineers or Signal Corps. The advanced course (MS III & MS IV) is presented during the Middler, Junior, and Senior years. Graduates of the advanced course receive commissions as second lieutenants in the U. S. Army Reserve or Regular Army.

Enrollment in Basic Course

Enrollment in ROTC basic course is voluntary and is open to all male undergraduate students of the Colleges who are citizens of the United States, are physically qualified, and who can qualify for appointment as Second Lieutenant prior to reaching 28 years of age. The basic course may be entered only at the beginning of the freshman year, except for veterans for whom some or all of the basic course may be waived.

Eligibility for the Advanced Course

The ROTC advanced course is available to male undergraduate students of the Colleges who complete the basic course, or to honorably discharged veterans whose service can be substituted for the basic course, who: are citizens of the United States and will not have reached 28 years of age at the time of commissioning; successfully complete such survey and general screening tests as may be prescribed; have three academic years to complete for graduation (two for full time); are selected by the PMST and the University within quotas available in any year; execute a written contract with the government; and successfully complete a U. S. Army physical examination.

Eligibility for ROTC Flight Training

Northeastern University was among the original group of Universities and Colleges in the U. S. at which the Army ROTC Flight Training Program was introduced in 1956. This training is available during the senior year to specially selected cadets who successfully complete U. S. Army Aviator aptitude and physical tests. Flying instruction is conducted on an extracurricular basis by civilian flying schools, under contract to the University and U. S. Army. An Army Aviator Faculty Member supervises the program. Cadets successfully completing the course receive a Civil Aeronautics Administration Private Pilot's certificate.

Veterans

Honorably discharged veterans (enlisted) may be enrolled in ROTC with one or both years of the basic course waived, depending on prior service. They must be co-aligned in ROTC with other members of their class in the University curricula. Veterans are a distinct benefit to the Corps of Cadets because their actual experiences lend color to the program and help to orient cadets without such service. They are especially desired and are appointed cadet noncommissioned officers or officers upon enrollment. Certain credits are available to veterans depending upon service. Former commissioned officer veterans are not eligible for ROTC. However, if they are reserve officers, they can earn inactive duty credits by participating in ROTC on a free-time basis. They may apply to the PMST.

Transfer Students

Students transferring into Northeastern University from other institutions, where ROTC similar to that at Northeastern has been taken, are allowed credits for their work. The student's former records are obtained from his former PMST. Such transfer students must be co-aligned in ROTC with other students in their classes.

Uniforms and Equipment

An Army officer's type uniform is issued without cost to ROTC students in the basic course. Advanced course students are individually fitted to a uniform, which becomes their personal property upon commissioning, and they continue to wear it as an officer after graduation. The Government furnishes \$100.00 towards this uniform and the student pays a small additional charge. All other equipment, textbooks, etc., required for instruction is provided without charge throughout the five-year program. These items remain the property of the Government, and students must safeguard them and use them in accordance with University and ROTC regulations. A \$10.00 deposit is required temporarily from all basic course students enrolling in ROTC until uniforms and property are returned in good condition. Any loss or damage to ROTC uniforms and equipment, exceeding the deposit, will be charged to the student.

Academic Credit

Academic credit is given for all ROTC work — a total of 24 hours during five years. The basic course may be substituted for physical education as a prerequisite for graduation. Eighteen credit hours are granted for the advanced course and twelve of these can be substituted for certain other courses as a prerequisite for graduation. Thus, time spent in the advanced course is not all over and above the regular curriculum. Many of the credit hours can be substituted for other elective academic work.

Pay and Other Benefits

ROTC benefits are both tangible and intangible. "Pay," earned by advanced course students, is actually a non-taxable allowance for subsistence at the rate of \$.90 daily. It is paid in increments of \$27.00 monthly during actual advanced-course instruction and also during Co-op terms up to a total of 595 days. Camp pay is \$78.00 monthly over and above housing, messing, and medical care, which are free at camp. Transportation to and from camp is paid at the rate of \$.05 per mile. Total income from ROTC amounts to over \$700.00 paid over the final three years of ROTC. This (over \$2.00 per hour for the 300 hours of the advanced course) is an important supplement to co-operative work income in offsetting tuition costs. Cadets also compete for ROTC scholarships with a total value of \$975.00.

Intangible benefits are even more important than "pay" in the long run, especially leadership development. The ROTC student is trained to be confident and self-reliant, especially in the advanced course. He becomes a cadet officer as he enters the advanced course in his middler year. For the final three years he gets a concentrated course in command, leadership, and personality development under senior Regular Army officers who have been selected personally for their abilities in this respect. Cadets respond quickly to this personalized training. They learn to stand up before classmates and to talk. This helps them to obtain positions of leadership on the campus, in the community, or at their places of business. As cadets progress, they participate in troop command and management, in public speaking, in exercises requiring understanding of practical and applied psychology, and in other similar fields leading to leadership and personality development. Each year brings increased responsibilities. In the senior year, cadets are promoted to positions of high leadership in the Corps of Cadets. They command the brigades, regiments, battalions, companies, and platoons, or serve in Cadet Grades from First Lieutenant to Brigadier-General. Top leaders in ROTC usually are top leaders on the campus.

There are many social activities and benefits associated with ROTC. Cadets are eligible for selection to honorary military societies such as Pershing Rifles and Scabbard and Blade. ROTC students compete for medals and other academic and leadership awards. They associate with many other cadets in the University ROTC Band, the University Rifle Club (Varsity, Freshman, Girls' and ROTC Rifle Teams), the Military Affiliate Radio System for "ham" radio operators, student chapters of national professional societies sponsored by the Armed Services, such as the Armed Forces Communications and Electronics Association and the Society of American Military Engineers, and in military news movies.

Draft Deferments

Public Law 51 (Universal Military Training and Selective Service Act of 1951 as amended by the Reserve Forces Act of 1955) permits students enrolled in ROTC, who are expected to attain appointments as commissioned officers in the Army Reserve, to be deferred from service for as long as they remain in good standing. ROTC deferment remains in effect until graduation or withdrawal from the University. An ROTC deferment is a matter of law and is not dependent upon the conditions pertaining in any one Selective Service Board at any one time.

Distinguished Military Students

There are "military honors" for ROTC graduates similar to "academic honors" for regular graduates. Honor graduates of ROTC are called "Distinguished Military Graduates." If physically qualified and they apply for it, they can be commissioned in the Regular Army, instead of the Army Reserve, and enter into a Regular Army career exactly the same as graduates of the United States Military Academy at West Point. This is a splendid opportunity for those who are interested in the many advantages of a Regular Army career. However, since ROTC is primarily for students who pursue civilian careers, the Distinguished Military Graduate who does not desire a Regular Army career benefits from his Commencement "military honors" as he would from any other Commencement honors. This honor is limited to about 15% of the senior class.

Cadets are eligible to be designated "Distinguished Military Students" in their junior year, when they possess outstanding qualities of leadership, high moral character, and definite aptitude for the military service; have attained an academic standing in the upper half of the class and in the upper third of their ROTC class, and, further, have demonstrated leadership ability through achievements while participating in recognized campus activities. Such cadets, who maintain creditable standing up to graduation, are designated "Distinguished Military Graduates."

The Army as a Career

By following any curricula leading to a degree, and by completing the ROTC Program, a student may qualify for a full-time career in the Regular Army. Cadets who have been designated Distinguished Military Students may apply in September of the senior year for an appointment in the Regular Army. They are notified as to selection before Christmas, subject to graduation, designation as Distinguished Military Graduates, and physical qualification. They then become Regular Army Officers, with all conditions and opportunities for graduate education, etc., exactly the same as for graduates of the U. S. Military Academy at West Point. There are many advantages and opportunities in a Regular Army career. Pay and allowances compete favorably with civilian pay, and the retirement pay and benefits, after 30 years, are much higher than for most other careers. Since it is never too early to begin planning a career, students who are interested in a Regular Army appointment should make that fact known to the PMST as soon as possible.

An Army career as a Reserve Officer on extended Active Duty also is possible. Many graduates do not request a Regular Army appointment originally, but find Army service enjoyable and satisfying while serving their obligated tours of Active Duty. Those officers who request continuation and are accepted, serve in the Active Army as Reserve Officers, with the same pay, responsibilities, and opportunities for promotion as Regular Army Officers.

Most ROTC graduates pursue civilian careers and serve only limited tours of Active Duty. However they, too, can benefit from their part-time Army careers by participating in Reserve Unit training activities during evenings and at summer camp. They receive pay and accrue credit towards retirement at age 60 (after 20 years' service). Such part-time careers may result in eligibility for retired pay each month for the rest of their lives. This is a real financial security benefit, which is equivalent to a sizable annuity and is worth while for any person to seek.

Curriculum in Basic ROTC

FIRST YEAR												
TERM 1						TERM 2				TERM 3		
	Course	Cl.	Cr.	No.	Course	Cl.	Cr.	No.	Course	Cl.	Cr.	
61	Military Science I Mil. Fundamentals & Drill	1	(2)	1	61-02 Military Science I Amer. Mil. History	3	1	61-03 Military Science I Wpns & Marks-ship	1	(2)	1	
		1	(2)	1		3	1			1	(2)	1
SECOND YEAR												
TERM 4*				TERM 5				TERM 6				
5	Military Science II Mil. Fundamentals & Drill	1	(2)	1	61-11 Military Science II Wpns & Gunnery NCO Drill	1	(1) 0 (2)	1	61-12 Military Science II Map Reading Elem. Comm. & Tactics	2	1	
		1	(2)	1		1	(3)	1		1	(1)	
		1	(2)	1		1	(3)	1		3	(1)	

Curriculum in Signal Corps Advanced ROTC

THIRD YEAR			TERM 7*			TERM 8			TERM 9		
0	Military Science III Intr. to Leadership	2 0	61-21	Military Science III Applied Comm. Leadership & Cmd. Mil. Teaching Mtds.	1 0 (2) 2	61-22	Military Science III Allied Comm. Comm. Security	2 2			
		2 0			3 (2) 3			4 3			
FOURTH YEAR			TERM 10*			TERM 11			TERM 12		
0	Military Science III Signal Orders	2 0	61-31	Military Science III Radio Fundamentals Cmd. Speech & Psy.	3 0 (2)	61-32	Military Science IV Mil. Radio Systems Advanced Comm.	2 2			
		2 2			3 (2) 3			4 3			
FIFTH YEAR			TERM 13*			TERM 14			TERM 15		
0	Military Science IV Military Law	3 0	61-41	Military Science IV Mil. Admin. & Staff Procedures Logistics Leadership & Cmd.	1 2 0 (2)	61-42	Military Science IV Mil. Tel. Systems Service Orientation	3 1			
		3 0			3 (2) 3			4 3			

Curriculum in Corps of Engineers Advanced ROTC

RD YEAR			TERM 7*			TERM 8			TERM 9		
0	Military Science III Intr. to Leadership	2 0	61-61	Military Science III Mil. Teach. Mtds. Field Fortifications Leadership & Cmd.	2 1 0 (2) 3 (2) 3	61-62	Military Science III Mine Warfare Mil. Structures	1 3 4	1 2 3		
THIRD YEAR			TERM 10*			TERM 11			TERM 12		
0	Military Science III Mil. Explosives	2 0	61-71	Military Science III Mil Construction Cmd. Speech & Psy.	3 0 (2) 3 (2) 3	61-72	Military Science IV Log. & Mil Const. Mil. Adm.	3 1 4	2 1 3		
FOURTH YEAR			TERM 13*			TERM 14			TERM 15		
0	Military Science IV Staff Procedures	3 0	61-81	Military Science IV Military Law Buildings & Utilities Leadership & Cmd.	2 0 2 1 0 1 0 (2) 3 (2) 3	61-82	Military Science IV Opns. of Eng. Units Service Orientation	3 1 4	3 3		

Week Term. () indicate drill and practice.

Div. A curriculum is listed. Div. B differs with a spring rather than fall drill term and sequence of instruction in 10-week terms is reverse of Div. A. Therefore transfers between divisions require individual consideration.

General Information

Policy on Changes of Program

The University reserves the right to withdraw, modify, or add to the courses offered or to change the order or content of courses in any curriculum.

The University further reserves the right to change the requirements for graduation, tuition, and fees charged, and other regulations. However, no change in tuition and fees at any time shall become effective until the school year following that in which it is announced.

Any changes which may be made from time to time pursuant to the above policy shall be applicable to all students in the school, college, or department concerned, including former students who may re-enroll.

Textbooks and Supplies

The Northeastern University Bookstore, located on the ground floor of Richards Hall, is a department of the University and is operated for the convenience of the student body. All books and supplies which are required by the students for their work in the University may be purchased at the Bookstore.

Part-time Work

Students who find it necessary to accept part-time jobs while attending college may obtain such work through the Dean of Students Office.

Students are not justified in assuming that the University will take care of their expenses or guarantee to supply them with work sufficient to meet all their needs.

A student should have available funds adequate to enable him to meet the expenses of the freshman year. This should amount to at least the first year's tuition plus books and supplies, room and board for thirty weeks.

Grades and Examinations

Examinations

Examinations covering the work of the term are usually held at the close of each term. Exceptions may be made in certain courses where, in the opinion of the instructor, and with the approval of the Dean of the College concerned, final examinations are not necessary.

Condition Examinations

Condition examinations are usually given once each year for each division. The charge is three dollars (\$3.00) for each condition examination.

The responsibility for the removal of a condition rests with the student, who is required to ascertain when and how the condition can be removed.

A student may take only one condition examination to remove a failure in a given course.

Special Final Examinations

Students who have been given permission to make up missed final examinations will be charged a single fee of \$5.00 covering all of the examinations missed during a given final examination period during a given period of illness.

Senior Condition Examinations

No condition examinations in last term senior courses are offered at the end of the last term. This means that a failure in a last term senior course cannot be made up before Commencement.

Grades

A student's grade is officially recorded by letter, as follows:

- A outstanding attainment
- B above-average attainment
- C average attainment
- D poor attainment, lowest passing grade
- F failure, removable by condition examination (students are permitted to take only one condition examination in a given course)
- I incomplete, used for intermediate grades only to signify that the student has not had time to make up work lost through excusable enforced absence from class
- L used in all cases of the removal of a failure by condition examination or by attendance at summer term
- WP Withdrew from course — passing
- WF Withdrew from course — failing

Students who acquire more than three uncleared failures or whose weighted average for the year is below 1.4 will not be permitted to register for advanced work.

The responsibility for the removal of a condition rests with the student, who is required to ascertain when and how the condition can be removed.

Dean's List

A Dean's List, issued at the end of each term, contains the names of upperclass students who have a 3.0 weighted average in all subjects with no grade below C during the preceding period. Freshmen who meet the same standards in their work are included on a Freshman Honor List. No student subject to disciplinary action is eligible for either list.

Reports on Scholastic Standing

Reports for all students are issued at the end of each grading period. Questions relative to grades are to be discussed with the student's faculty adviser.

Students are constantly encouraged to maintain an acceptable quality of college work. Parents and students are always welcomed by the college officers and faculty advisers for conference upon such matters.

Parents or guardians will be notified whenever students are advised or required to withdraw from the University. If parents so request, report cards will be sent to them instead of to the student.

General Conduct

Conduct

It is assumed that students come to the University for a serious purpose and that they will cheerfully conform to such regulations as may from time to time be made. In case of injury to any building or to any of the furniture, apparatus, or other property of the University, the damage will be charged to the student or students known to be immediately concerned; but if the persons who caused the damage are unknown, the cost for repairs may be assessed equally upon all the students of the University.

Students are expected to observe the accepted rules of decorum, to obey the regulations of the University, and to pay due respect to its officers. Conduct inconsistent with the general good order of the University or persistent neglect of work may be followed by dismissal; if the offense be a less serious one, the student may be placed upon probation. The student so placed upon probation may be dismissed if guilty of any further offense.

It is desired to administer the discipline of the University so as to maintain a high standard of integrity and a scrupulous regard for truth. The attempt of any student to present any work which is not his or her own, or to pass any examination by improper means, is regarded as a most serious offense and renders the offender liable to immediate expulsion. The aiding and abetting of a student in any dishonesty is also held to be a grave breach of discipline.

Attendance

Students are expected to attend all exercises in the subjects they are studying unless excused in advance.

No cuts are allowed. A careful record of each student's attendance upon class exercises is kept. Absence from regularly scheduled exercises in any subject will seriously affect the standing of the student. It may cause the removal of the subject or subjects from the student's schedule.

Laboratory work can be made up only when it is possible to do so during hours of regularly scheduled instruction.

Absences from exercises immediately preceding or following a recess are especially serious and entail severe penalties.

Attendance at all mass meetings of the student body is compulsory. Exceptions to this rule are made only when the student has received permission from the Director of Student Activities previous to the meeting in question.

Freshman Counseling

Freshman Orientation Period

In order that freshmen may be ready to pursue their academic work with greater composure and be somewhat acclimated before the beginning of scholastic work, three or four days prior to the first term are devoted to a freshman orientation period. All freshmen are required to attend all exercises at the University scheduled during the orientation period.

Freshman Orientation Class

All freshmen attend an orientation class once each week for the first fifteen weeks. This class is designed to instruct the student in the traditions, activities, and procedures of the University. Time is devoted to the proper methods of study for success in college and stress is placed on attitudes for success in later life. About a third of the classes are devoted to techniques and procedures of work under the Co-operative Plan.

Physical Examination

All freshmen receive a physical examination at the University during the orientation period. All students are expected to report promptly at the appointed time for examination. Those who fail to appear at the appointed time will be charged a special examination fee of two dollars (\$2.00).

Freshman Counselors

At the time of matriculation each freshman is assigned to a personal adviser, a member of the faculty, who serves as an interested and friendly counselor during the perplexing period of transition from school to college. The aim of the freshman advisory system is primarily to guide students through their first year. General counseling is under the direction of the Dean of Freshmen and the Dean of Students, assisted by a clinical psychologist, who handles the diagnosis and remedial treatment of difficult problem cases. Direct counseling of women students is under the supervision of the Dean of Women.

Individual Attention to Freshmen

Attention is given not only to the scholastic problems of the student, but also to personal problems in which advice is needed and desired. The aim is to help the student to the fullest possible personal development.

The college records of all students are periodically analyzed in the light of what may reasonably be expected from them in view of their previous school record, their scores on psychological tests, and all other factors in their situations. If they are not doing their best work, investigations are made to determine and eliminate the causes.

Testing and Counseling Center

The University through its Testing and Counseling Center is prepared to provide guidance for students who are uncertain about their educational objectives. This service is available without charge to all regularly enrolled students who desire such assistance. Students seeking help should apply through the Dean of Students Office.

Vocational counseling services are also available on a fee basis to high school students by referral from the Department of Admissions or by direct contact with the Testing and Counseling Center. Adults wishing vocational guidance are also served by this Center on a fee basis.

Occupational Information Service

The Occupational Information Service is equipped to provide information about various fields of work and about the educational requirements for these fields. Students may browse through books and pamphlets or may listen to tape recordings on various occupations. Of special interest are the recordings which describe life and activities at Northeastern as well as others which present information about the various programs of study available at Northeastern.

Student Housing

The University maintains dormitory facilities for both men and women students. These are located near the Huntington Avenue campus, but they accommodate only a portion of the men students who live away from home. The residences for women students are sufficient to provide for all girls who need such accommodations while they are at the University.

Women's Residences

Women's residences, under the supervision of house directors, are maintained by the University. Board (including three meals daily) and room is \$240.00 per ten-week term. Upperclass students whose co-operative work assignments are in the Boston area may live in the residences during work periods. Information regarding the residences may be secured from the Department of Admissions.

Women students living away from home are required to live in the women's residences unless other arrangements are approved in advance by the Dean of Women.

Freshman Men's Residence

The new dormitory for men is located on Hemenway Street within a four-minute walk of the University. Board (including three meals daily) is \$240.00 for each ten-week term, payable the first of that term. A room reservation non-returnable deposit of \$50.00 is required as soon as notice of definite room assignment is made. (This will be applied against the bill for the first term.) Applications for the men's residence may be filed with the Department of Admissions after a student has been accepted. Definite notice of room assignment is sent by the Dean of Freshmen in June. Students should write to the Department of Admissions for further information and Application for Residence.

Fraternity Housing

Certain fraternities provide excellent opportunities for room and board for men at reasonable rates. Information regarding these housing facilities may be obtained from the Dean of Students Office.

Regulations Concerning Rooming Houses

Inasmuch as some men students who are living away from home cannot be cared for in the present University dormitories or fraternity houses, the Dean of Students' Office is charged with the responsibility of assisting such students to find suitable rooms in the vicinity of the University campus. The following rules and regulations apply to such arrangements:

1. A list of rooming houses which have been inspected and approved for use by Northeastern University students is maintained by the Dean of Students' Office. General information as to price, type of room, and location, can be obtained in advance of registration, and the student may visit several possible rooms before making his decision.
2. First year students who are unable to be housed in the Freshman Men's Residence must live in a residence inspected and approved by the University, unless they furnish the Dean of Students a statement from their parents permitting them to live elsewhere.
3. If a student has rented a room obtained through the assistance of the Dean of Students' Office, he must notify the Registrar of his local address.
4. Although the University does not encourage students to rent apartments, it is recognized that this living arrangement is acceptable to many parents. The rental of apartments by groups of students will therefore be approved for upperclassmen only under the following conditions:
 - (a) Upperclassmen over 21 years of age may rent apartments if they have an approved request filed in the Dean of Students' Office.
 - (b) Upperclassmen under 21 years of age may rent apartments only after they have a written consent from their parents filed with the approved request in the Dean of Students' Office.
5. The University is concerned to know the conditions under which students away from home are living and to provide landladies with necessary information about University regulations and about reporting students who may need medical care. It is the responsibility of every student to keep the Registrar's Office informed at all times as to his residence while he is enrolled at the University.

The Alumni Association

The 12,000 alumni of the Colleges are organized to promote the welfare of Northeastern University and to perpetuate the spirit of fellowship among members of the Alumni Association. Headquarters of the Association are in the Alumni Office located in Room 125 of Richards Hall, where records and addresses of alumni are on file.

The official publication is the *Northeastern Alumnus*, which is published quarterly and is sent to all subscribers to the annual Alumni Fund. Once a year the alumni are solicited through the Alumni Association. The funds are used to provide an annual gift to the University, finance the activities of the Alumni Association, and publish the *Alumnus*.

Regional Alumni Clubs have been established from Maine to California. These clubs meet periodically, often in conjunction with visits of members of the faculty and the athletic teams to the various club centers.

The Association presents annually, at the Alumni Convocation, the Alumni Award for professional promise to a senior in each of the four Day Colleges.

The climax of the year's activities is the Alumni Federation Day held in the spring. Reunions of various classes are also conducted during June.

The Alumni Association of the Day Colleges is a member of the Alumni Federation, which consists of the Alumni Association of the Day Colleges, of the School of Business, and of the School of Law.

The organization of the Alumni Association is as follows:

Officers

President

CHARLES M. MCCOOMBE '26

Senior Vice-President

DONALD C. MOODY '23

Vice-President — Alumni Affairs

KENNETH C. PERKINS '51

Vice-President — Alumni Clubs

HARVEY S. MILLER '41

Secretary

NANCY J. CARUSO '52

Treasurer

ALBERT J. OLIVA '30

Executive Committee

HYMAN H. BURSTEIN '36

FRANK C. HARRINGTON '24

JOHN J. HEAVEY, JR. '51

JOSEPH C. LAWLER '44

ABRAHAM POLEY '25

LOREN B. SJOSTROM '35

Alumni Council

HARRY CIKINS '17

EBEN O. SMITH '17

NORMAN E. CHENEY '21

C. ROGER PEARSON '22

WALDO ENGSTRAND '23

HOWARD L. LEAVITT '24

PAGE SANDERSON '26

GEORGE F. MARDEN '27

JOHN E. BOBULA '28

HYMAN SILVERMAN '29

JAMES J. LEAHY '30

STEPHEN HASELTINE, JR. '31

ALFRED E. LONNBERG '32

LORRIN M. PITTENDREIGH '34

PAUL A. HILLMAN '35

JAMES L. DALLAS '36

ALBERT A. SHAMES '37

PHILIP A. SMALL '38

JOSEPH F. CLANCY '39

CURTIS R. GANONG '40

STUART B. MATHESON '41

ROBERT I. BROWN '42

RICHARD E. CARVILL '43

DONALD H. FEENER '44

S. ROBERT CONVISOR '45

ARNOLD P. WEINER '46

WALTER BORDEWIECK '47

FRANK LAMBERT '48

AUGUSTUS VENTRE '49

PETER S. SIKALIS '50A

ROBERT B. THOMSON '50CFT

SIDNEY CASHTON '50C

FRANK J. RANDO '51

JAMES L. NEVINS, JR. '52

WILLIAM F. LYNCH '53

JOHN R. MULKERN '53

NORMAN H. MARTIN, JR. '54

ROBERT E. MATTSON '55

ALFRED J. DURATTI, JR. '56

JOHN R. PARADIS '57

FRANCIS E. WRIGHTINGTON '58

Director of Alumni Relations

RUDOLF O. OBERG '26

Assistant to the Director of Alumni Relations

CHESTER W. STOREY '59

THE COLLEGE OF LIBERAL ARTS

Aims

IN PROVIDING the means to a modern liberal education, the College of Liberal Arts of Northeastern University has a threefold objective: first, intellectual growth; second, the development of a well-rounded personality; and third, preparation for a vocation.

Intellectual growth rests upon the foundation of a sound general education. Through the required and elective courses of all curricula, students are guided toward an understanding of the leading ideas, significant facts, and the habits of thought and methods of work in the areas of language, natural science, social science, and the humanities. With this training the student will appreciate more fully the basic values upon which civilization and culture rest, and perceive and accept his responsibilities as an active participant in social groups — the family, the community, the nation, and the world. At the same time the student is aided in the development of a resourceful and independent mind, the ability to use as well as to accumulate knowledge, and the awareness of his mental strengths and weaknesses.

The College of Liberal Arts endeavors to assist each student in attaining the goal of an emotionally balanced, well-rounded personality. Its academic, extra-curricular, and co-operative work programs provide experiences conducive to the development of strength of character and a sense of personal responsibility — including such personal qualities as self-reliance, integrity, perseverance, and the ability to work with others.

Since liberal arts colleges were originally established for the purpose of training for certain professions, the College of Liberal Arts holds that there is no inconsistency between a truly liberal education and preparation for a vocation. Today it is widely accepted that a liberal education must prepare both for the art of living and the obtaining of a living. Through its academic program coupled with co-operative work experience, the College of Liberal Arts offers young men and women a sound training either for further graduate study or for immediate entrance upon graduation into some vocation.

Methods

To enable each student to plan a college program in keeping with his own interests and aptitudes, a wide range of electives is offered. This does not mean that students are free to elect courses indiscriminately, for if they are to obtain a liberal education they must have training in several basic fields. Therefore, a definite series of basic courses in each curriculum is required by the faculty. These required courses are largely concentrated in the first two years of the curriculum.

Through a comprehensive guidance program students are directed in their selection of courses so that they obtain the proper preparation for their intended vocations. Specialization in a major field is emphasized during the latter part of the curriculum and is facilitated by the opportunity for electing certain courses in the other Colleges of the University.

Through the Northeastern plan of co-operative education for upperclassmen, the student makes early contact with actual working conditions and profits by the wholesome experience of earning at least part of the money to defray college expenses. Viewed as a whole, then, the college years surround the student not with an artificial atmosphere of cloistered scholarship but with an environment very close to that which he or she will enter after graduation, and thus tend to make for more ready employment, an essential element of vocational competence.

Evening Division

In order to serve men and women who are engaged in full-time employment during the day, a number of the regular courses are offered in the evening. Curricula are offered leading to the associate and baccalaureate degrees in certain non-science fields.

Preparation for a Career

The curricula in the College of Liberal Arts afford not only a broad cultural training but also the necessary foundation for a wide range of vocations for both young men and young women. Some of the career opportunities open to the graduates of the College of Liberal Arts together with the academic programs needed are indicated below and in the pages which follow.

Art — The courses in art provide a liberal education in the history of art, and train men and women for professional work in industrial drafting and tracing, advertising design, commercial art, or teaching, dependent upon the nature of the elected program. An appreciation of art is developed through progressive courses in art history which include studies of materials, techniques, and methods used by master craftsmen. Paralleling these academic studies, courses in applied art provide adequate training for employment in engineering drafting rooms or commercial art studios.

Business — The value of a liberal arts preparation for a business career is clearly shown by the fact that a very large proportion of all graduates of liberal arts colleges enter business. Within recent years there has arisen an increasing demand for liberal arts graduates by the largest and most progressive corporations in the country. For their training programs in manufacturing, merchandising, selling, and other fields, many companies are seeking adaptable young men and women with the breadth of background of a liberal arts education.

Students planning either to go to a graduate school of business administration or to enter business directly upon graduation should major in economics and should elect courses in English, government, and psychology. A limited number of specialized courses in the College of Business Administration such as advertising, business law, finance, industrial management, insurance, investments, marketing, and merchandising may be taken by students who have had the necessary prerequisites.

Biological Sciences — Students who major in biology can arrange programs which will lay the foundation for the following careers: teaching, dentistry,

medicine (see premedical curriculum), veterinary medicine, public health, sanitation and laboratory methods; research in biology with universities, private research institutions, and governmental agencies under state and federal control; agriculture; and professional work in zoology and its applied fields such as fisheries, animal husbandry, and biology survey. Graduate study is essential for most of these careers.

Chemistry — The subject matter of the chemistry curriculum is composed of four broad fields: inorganic chemistry, analytical chemistry, organic chemistry, and physical chemistry. Chemists are employed in research, development, production, sales, market research, purchasing, and teaching. Women chemists find openings in some of these fields as well as in medical research and as technical librarians. Students who choose a chemistry major at Northeastern, a program accredited by the American Chemical Society, will be prepared to enter these fields upon graduation.

The same program provides a thorough foundation for those who wish to continue in graduate studies for a higher degree.

Dentistry — The minimum requirement for admission to dental schools is two years of preliminary study in an approved college. Since the requirements of individual dental schools vary, students should familiarize themselves with the specific requirements of the schools in which they are interested. For most dental schools a candidate for admission must offer at least one year of work in English, physics, and biology, and one and one-half years of work in chemistry, including organic chemistry.

Predental students at Northeastern will be able to meet these requirements by taking the two-year predental program. A third year may be taken by those students who desire to obtain a broader educational background, and who wish to qualify for the B.S. degree under the Combined Program described on page 70.

Government Service — Government service is a very comprehensive term since the numerous activities of modern government require all types of trained workers. For more and more of these positions a college education is essential as shown by the fact that only college graduates are eligible to take many civil service examinations in such fields as biology, business analysis, economics, editing, fiscal analysis, mathematics, physics, psychology, social work, sociology, and statistics.

The distinctive governmental career field is that of public administration since the need for college trained personnel in administrative governmental posts of all types, political or nonpolitical, is being increasingly recognized. While graduate training is desirable, an undergraduate program with a major in history-government and a minor in economics will provide the necessary foundation for a career in government service at home or abroad.

For career opportunities in the United States Army see page 54.

Journalism — Many of the nation's leading editors now advise students preparing for a career in journalism to obtain a broad liberal arts education rather than to concentrate on specific training in the routines of journalism in their undergraduate programs. It should be observed that opportunities in journalism today are not restricted to the urban or rural newspaper fields. Publishing houses, trade journals, house organs, advertising departments and agencies, radio and

television studios, and the various types of public relations work need college graduates with the same basic training.

Students who desire to enter journalism should choose the English-journalism major with a minor in economics, history, or government. They may elect courses in advertising in the College of Business Administration.

Law — Approved law schools now require at least three years of acceptable college work for admission. Since admission requirements of law schools vary, all prelegal students should ascertain the specific requirements of the law school of their choice.

The prelegal curriculum listed on page 80 will prepare a student for admission to any law school requiring three years of college work. Under the combined program described on page 70 it is possible for most students to obtain both the A.B. and LL.B. degrees in six years.

Library Work — Professional training for library work now demands at least one year of graduate study in a library school following a broad undergraduate foundation. Although many students planning on this field major in English, excellent opportunities are available for students who have majored in any area.

Mathematics — A recent bulletin of the United States Department of Labor lists the following occupational titles in fields other than teaching for those who have majored in mathematics: Actuarial statistician, actuary, computer, mathematical aide, mathematical assistant, mathematician, statistical clerk, and statistician. Opportunities for such positions are to be found in government service, insurance companies, and industry. A rapidly developing new field for mathematics majors is programming for digital and other types of modern computers and data-processing devices. For advanced types of mathematical work graduate study is necessary.

Medical Technology — To be eligible to take the examination for certification as a Medical Technologist by the Registry of Medical Technologists of the American Society of Clinical Pathologists, a candidate must have completed a three-year college program including specified work in biology and chemistry prior to taking technical training in medical technology for at least twelve consecutive months in a school of medical technology approved by the Council on Medical Education and Hospitals of the American Medical Association.

The program on page 82 has been approved by the Registry of Medical Technologists as meeting their requirements for basic college preparation. Qualified candidates then enter a school of medical technology in an approved hospital and receive their technical training in biochemistry, hematology, bacteriology, parasitology, histology, serology, and other subjects. Upon the successful completion of this work the candidate is eligible to take the examination for certification as a Medical Technologist (M.T.) by the Registry of Medical Technologists, recognized as the authoritative qualifying body for this field.

Medicine — In order to be eligible for admission to a medical school according to the Committee on Education of the American Medical Association, a candidate must have attended an approved college and have included certain specific work in his program. The minimum course requirements include year courses in each of the following fields: English, inorganic chemistry, organic chemistry, physics, and a foreign language. Since some medical schools impose additional

requirements, premedical students should obtain full information from the medical school of their choice about the courses which must be offered for admission.

The premedical curriculum listed on page 81 will enable students to meet all the above standard requirements. The electives make it possible to obtain any particular additional courses required by some medical schools.

Students are cautioned that the successful completion of the required premedical program by no means insures admission to a medical school. Since most medical schools have far more applicants than they can admit, standards of selection are most rigorous and take into consideration not only the quality of the applicant's academic record and instructor's recommendations but also his or her medical-aptitude test score and the results of a personal interview.

Premedical students should note the combined program described on page 70.

Ministry — Preparation for the ministry today requires a theological school training following graduation from an approved college of liberal arts. The American Association of Theological Schools states that the appropriate foundation for a minister's later professional studies lies in a broad and comprehensive college education and that the normal place for a minister's professional study is the theological school. Recommended fields of study include English, economics, education, government, history, foreign languages, one of the natural sciences, philosophy, psychology, and sociology.

While students who major in English, economics, psychology, or sociology will be able to arrange programs meeting the above recommendation, it is urged that preministerial students obtain counsel from the dean of the theological school of their choice since some schools have further specific requirements.

Modern Languages — A major in Modern Languages is available for those students who have obtained a strong foundation in one language (French, German or Spanish) in high school and begin a second one in the freshman year at college.

Besides secondary school teaching, there are other fields, such as certain branches of government service, international business relations, journalism, and library science, in which a knowledge of foreign languages is either required or desirable.

Physics — As a result of the rapid developments in physics in recent years, there are increasing opportunities in applied physics on the technical staffs and in the research laboratories of the electrical, electronics, missile, radio, optical industries, and in many government research agencies for the liberal arts graduate who has majored in physics. Graduate study is necessary for those who plan on research in pure physics.

Psychology — A wide variety of career opportunities exists for persons trained in psychology. Many psychologists are engaged in teaching at the university and junior college level. In the field of public school education, the demand is expanding for school psychologists, and for guidance and vocational counselors. Increasing numbers of psychologists are employed in business and industry, in such areas as marketing research, advertising, personnel work, and employee selection. State and federal hospitals, as well as child guidance clinics, employ large numbers of psychologists who deal with the diagnosis and treatment of

the emotionally ill. Many psychologists are engaged in full-time research, studying various aspects of human behavior.

It should be noted that most of these positions require that the applicant have academic training beyond the undergraduate level, and a large number required that he have the Ph.D. degree. Those who aspire to a career in psychology should view their undergraduate work as preparatory for advanced study in the area. The student who does not expect to obtain graduate training will find, in an undergraduate concentration in psychology, an opportunity to obtain a well-balanced education, as well as an increased understanding of his own and others' behavior.

Secretarial Work — Today there are excellent opportunities for college graduates, regardless of their majors, who can qualify for secretarial positions. A sequence of elective courses in secretarial studies is open to all students in the College of Liberal Arts who wish to prepare themselves for this avenue to advancement.

Sociology — Sociology majors find their undergraduate training of value, and are increasingly in demand in such important and interesting fields of work as college teaching, social work, social research projects, personnel work in business and industry, and government positions in a wide range of areas.

For those desiring to do further work in the first three fields, graduate training for at least one or two years is almost always required. For other fields of work, however, little or no graduate training is necessary.

Statistical Work — The growing emphasis upon statistics in business, education, social service, and government has opened a new career field for the student who majors in mathematics and obtains preparation in statistics. Similar training is necessary for students who wish to enter the actuarial field.

Teaching (Secondary School) — While a major in education is not offered in the College of Liberal Arts, a minor in this field is available, from courses offered by the College of Education, which meets the requirements of the Department of Education of the Commonwealth of Massachusetts for teachers in secondary schools. Students from other states should familiarize themselves with the requirements of their own state, as these requirements are constantly being increased.

Most small secondary schools, in which the graduate must begin, expect teachers to be able to teach at least two, and often three, subjects. Consequently programs should provide for the common combinations of related subjects. A major should be selected from the following fields: biology, chemistry, English, history-government, modern languages, or mathematics-physics. Qualified seniors will be able to do supervised student teaching in lieu of co-operative work.

Students who desire to become teacher-coaches may minor in physical education, provided they elect the required courses in education.

Teaching (College) — Students who plan to enter the college teaching profession will find that each of the major programs affords an excellent preparation for graduate study in the leading universities of the country. Since graduate schools usually require a reading knowledge of French or German, frequently both, students should elect adequate work in these languages. Seminar and research courses are strongly recommended for their training in research techniques.

Admission Requirements

Applicants for admission to the freshman class must qualify by graduation from an approved course of study in an accredited secondary school, including prescribed subjects listed on page 29.

Requirements for Graduation

Degrees

The College of Liberal Arts awards the Bachelor of Arts degree to qualified candidates who have majored in economics, English, English-journalism, history and government, modern languages, psychology, or sociology.

The Bachelor of Science degree is awarded to qualified candidates who have majored in biology, chemistry, mathematics, physics, or have taken the pre-medical curriculum.

Quantity Requirements

Candidates for a degree must have completed one of the curricula listed on pages 71-84. Each curriculum provides for at least 48 credit hours of advanced work in a major field and at least 24 credit hours of prescribed or relative upper-class courses in a minor field.

All candidates for a degree must have satisfactorily completed in college one year of a modern foreign language above the elementary level.

Students who undertake co-operative work assignments must meet the requirements of the Department of Co-operative Work before they become eligible for their degrees.

No student transferring from another college or university is eligible to receive a degree until at least one year of academic work immediately preceding graduation has been completed at Northeastern.

Quality Requirements

An average grade of C is required for graduation.

Graduation with Honor

Candidates who have achieved distinctly superior attainment in their academic work will be graduated with honor. Upon special vote of the faculty a limited number of this group may be graduated with high honor or with highest honor. Students must have been in attendance at the University at least three years before they may become eligible for honors at graduation.

Curricular Requirements

The following fields of study are approved as major fields in the College of Liberal Arts: biology, chemistry, economics, English, English-journalism, history and government, mathematics, modern languages, physics, premedical, psychology, and sociology. In addition, programs are approved for preidental, prelegal and premedical technology students.

Students may elect their minor fields after consultation with their faculty advisers. In addition to the major fields listed above, the following subjects are available as minors: art, education, French, German, philosophy, physical education, and Spanish.

The required courses in each curriculum are indicated on the following pages. Upon petition to the faculty, substitutions may be permitted in exceptional cases when required by the specific vocational objective of the student.

During the last year students in all curricula are required to take 50-10 Placement Techniques designed to prepare them for placement in specific positions in their chosen vocational field. Under expert guidance each student prepares a complete personnel record, studies himself or herself and the opportunities that are open, and works out a complete campaign for obtaining after-graduation employment. Qualified students planning to go to graduate school may be excused upon petition to the faculty.

Combined Program with Professional Schools

Students entering after September 1, 1953, who have completed before entering an approved professional school of dentistry, law, or medicine at least three-quarters of the work required for the baccalaureate degree at Northeastern University, of which at least two-thirds has been earned in residence here and who have fulfilled all other graduation requirements, will be granted the bachelor of arts or the bachelor of science degree upon receipt of the professional degree. The residence requirement at Northeastern University must have been completed immediately prior to entrance into the professional school. Under this plan pre-professional students may reduce by one year the time ordinarily required for obtaining both degrees.

Four-Year Plan

Except for Pre-professional Programs, all curricula in the College of Liberal Arts are normally organized on the five-year Co-operative Plan which is the distinctive feature of Northeastern University.

However, in all majors except chemistry and physics, qualified students may be excused from the Co-operative Plan by the Dean and may complete the requirements for the degree in four years.

Curriculum in Biology

FIRST YEAR†

TERM 1			TERM 2			TERM 3		
No.	Course	Cl. Cr.	No.	Course	Cl. Cr.	No.	Course	Cl. Cr.
-01	English	3 3	30-02	English	3 3	30-03	English	3 3
-01	Gen. Chem.	3 (3) 4	11-02	Gen. Chem.	3 (3) 4	11-03	Gen. Chem.	3 (3) 4
-21	Basic Math.	3 3	14-22	Basic Math.	3 3	14-23	Basic Math.	3 3
-01	Gen. Biol.	2 (3) 3	10-02	Gen. Biol.	2 (3) 3	10-03	Gen. Biol.	2 (3) 3
	Mod. Lang.			Mod. Lang.			Mod. Lang.	
	Elective	3 3		Elective	3 3		Elective	3 3
-10	Phys. Ed.	0 (2) 0	16-11	Phys. Ed.	0 (2) 0	16-12	Phys. Ed.	0 (2) 0
		14 (8) 16			14 (8) 16			14 (8) 16

SECOND YEAR

TERM 4*			TERM 5			TERM 6		
-04	Gen. Biol.	3 (3) 2	10-55	Comp. Anat.	3 (3) 4	10-56	Comp. Anat.	3 (3) 4
-05	Gen. Chem.	3 (3) 2	11-26	Org. Chem.	3 (3) 4	11-27	Org. Chem.	3 (3) 4
-11	Gen. Phys.	6 3	15-12	Gen. Phys.	3 (3) 5	15-13	Gen. Phys.	3 (3) 5
	Mod. Lang.			Mod. Lang.			Mod. Lang.	
	Elective	3 1½		Elective	4 4		Elective	4 4
		15 (6) 8½			13 (9) 17			13 (9) 17

THIRD YEAR

TERM 7*			TERM 8			TERM 9		
Elective	5	2½	10-40	Physiology	3 (3) 4	10-41	Physiology	3 (3) 4
Elective	5	2½	11-28	Org. Chem.	4 (3) 5	11-45	Biol. Chem.	4 4
Elective	5	2½		Elective	4 4		Elective	4 4
				Elective	4 4		Elective	4 4
	15	7½			15 (6) 17			15 (3) 16

FOURTH YEAR

TERM 10*			TERM 11			TERM 12		
Elective	5	2½	10-61	Embryology	3 (3) 4	10-62	Embryology	3 (3) 4
Elective	5	2½	10-59	An. Histol.	3 (3) 4	10-60	An. Histol.	3 (3) 4
Elective	5	2½	11-17	Quant. Anal.	3 (3) 4	11-18	Quant. Anal.	2 (3) 3
				Elective	4 4		Elective	4 4
	15	7½			13 (9) 16			12 (9) 15

FIFTH YEAR

TERM 13*			TERM 14			TERM 15		
Elective	5	2½	10-20	Gen. Bact.	3 (3) 4	10-21	Gen. Bact.	3 (3) 4
Elective	5	2½		Biol. Elect.	4 4		Biol. Elect.	4 4
Elective	5	2½		Elective	4 4		Elective	4 4
				Elective	4 4		Elective	4 4
	15	7½		50-10	Place. Tech.			
					2 1			
					17 (3) 17			15 (3) 16

Summer term — 5 weeks. () indicate laboratory hours.

† If physically qualified male freshmen may elect ROTC if they so desire. Students accepted for the ROTC will not be required to take Physical Training in Terms 1, 2, 3, and will be permitted to substitute advanced ROTC courses for certain upperclass academic work as approved by the Dean up to a maximum of 12 credits.

Curriculum in Chemistry

FIRST YEAR†

TERM 1

No. Course	Cl.	Cr.
30-01 English	3	3
11-01 Gen. Chem.	3 (3)	4
14-61 Math. I	5	4
15-51 Physics	3	3
32-01 El. German	3	3
16-10 Phys. Ed.	0 (2)	0
	17 (5)	17

TERM 2

No. Course	Cl.	Cr.
30-02 English	3	3
11-02 Gen. Chem.	3 (3)	4
14-62 Math. II	5	4
15-52 Physics	3	3
32-02 El. German	3	3
16-11 Phys. Ed.	0 (2)	0
	17 (5)	17

TERM 3

No. Course	Cl.	Cr.
30-03 English	3	
11-03 Gen. Chem.	3 (3)	
14-63 Math. III	5	
15-53 Physics	3	
32-03 El. German	3	
16-12 Phys. Ed.	0 (2)	
	17 (5)	

SECOND YEAR

TERM 4*

11-05 Gen. Chem.	3 (3)	2
14-64 Math. IV	5	2½
15-54 Physics	5	2½
32-04 El. German	3	1½
	16 (3)	8½

TERM 5

11-51 Organic Chem.	3 (6)	5
14-05 Diff. Calc.	4	4
15-05 Physics	4 (3)	5
32-15 Inter. Ger.	4	4
	15 (9)	18

TERM 6

11-52 Organic Chem.	3 (6)	
14-06 Int. Calc.	4	
15-06 Physics	3 (3)	
32-16 Inter. Ger.	4	
	14 (9)	

THIRD YEAR

TERM 7*

Elective	5	2½
Elective	5	2½
Elective	5	2½
	15	7½

TERM 8

11-53 Org. Chem.	3 (3)	4
11-61 Phys. Chem.	3 (3)	4
15-14 Ad. Physics	3 (2)	4
20-11 Economics	3	3
	12 (8)	15

TERM 9

11-62 Phys. Chem.	3 (3)	
15-15 Ad. Physics	3 (2)	
20-12 Economics	3	
Elective	4	
or		
11-45 Biochem.		
	13 (5)	

FOURTH YEAR

TERM 10*

11-70 Quant. Anal.	5 (6)	3
Elective	5	2½
Elective	5	2½
	15 (6)	8

TERM 11

11-63 Phys. Chem.	3 (3)	4
11-71 Quant. Anal.	3 (6)	5
11-41 Chem. Lit.	3	3
Elective	3	3
or		
14-07 Diff. Eq.		
	12 (9)	15

TERM 12

11-64 Phys. Chem.	3 (3)	
11-76 Inst. Anal.	3 (6)	
11-56 Org. Chem.	3	
Elective	3	
or		
14-08 Diff. Eq.		
	12 (9)	

FIFTH YEAR

TERM 13*

Elective	5	2½
Elective	5	2½
Elective	5	2½
	15	7½

TERM 14

11-91 Special Topics	3 (3)	4
11-93 Nuclear Chem.	3	3
11-57 Qual. Org. Anal.	0 (9)	3
11-81 Inorg. Chem.	3	3
50-10 Place. Tech.	2	1
Elective	4	4
	15 (12)	18

TERM 15

11-82 Inorg. Chem.	3	
11-92 Special Topics	3	
11-58 Org. Prep.	0 (9)	
29-03 Eff. Speaking	3	
Elective	4	
	13 (9)	

At least 28 credits of electives must be non-science.

*Summer term — 5 weeks. () indicate laboratory hours.

†All physically qualified male freshmen may elect ROTC if they so desire. Students accepted for the ROTC will not be required to take Physical Training in Terms 1, 2, 3, and will be permitted to substitute advanced ROTC courses for certain upperclass academic work as approved by the Dean up to a maximum of credits.

Curriculum in Economics

FIRST YEAR†

TERM 1			TERM 2			TERM 3		
No.	Course	Cl. Cr.	No.	Course	Cl. Cr.	No.	Course	Cl. Cr.
01	English	3 3	30-02	English	3 3	30-03	English	3 3
01	West. Civ.	4 4	23-02	West. Civ.	4 4	23-03	West. Civ.	4 4
01	Am. Natl. Gov.	3 3	22-02	Am. Natl. Gov.	3 3	22-03	Am. Natl. Gov.	3 3
01	Surv. Sci.	3 3	17-02	Surv. Sci.	3 3	17-03	Surv. Sci.	3 3
	Mod. Lang.			Mod. Lang.			Mod. Lang.	
	Elective			Elective			Elective	
10	Phys. Ed.	0 (2) 0	16-11	Phys. Ed.	0 (2) 0	16-12	Phys. Ed.	0 (2) 0
		16 (2) 16			16 (2) 16			16 (2) 16

COND YEAR

TERM 4*			TERM 5			TERM 6		
04	Surv. Sci.	4 2	20-06	Ec. Prin. & Prob.	4 4	20-07	Ec. Prin. & Prob.	4 4
04	West. Civ.	4 2	25-01	Int. Psych.	4 4	25-02	Gen. Psych.	4 4
	Mod. Lang.		26-01	Prin. Soc.	4 4	26-02	Prin. Soc.	4 4
	Elective	3 1½		Mod. Lang.			Mod. Lang.	
04	English	5 2½		Elective	4 4		Elective	4 4
		16 8			16 16			16 16

THIRD YEAR

TERM 7*			TERM 8			TERM 9		
	Elective	5 2½	20-29	Inter. Econ.	4 4	20-30	Inter. Econ.	4 4
	Elective	5 2½	20-16	Acct. Prin.	3 (2) 4	20-17	Acct. Prin.	3 (2) 4
	Elective	5 2½		Elective	4 4		Elective	4 4
		15 7½		Elective	4 4		Elective	4 4
					15 (2) 16			15 (2) 16

FOURTH YEAR

TERM 10*			TERM 11			TERM 12		
	Elective	5 2½	20-20	Statistics	3 (2) 4	20-21	Statistics	3 (2) 4
	Elective	5 2½	20-18	Am. Ec. Hist.	4 4	20-28	Econ. Syst.	4 4
	Elective	5 2½		Elective	4 4		Elective	4 4
		15 7½		Elective	4 4		Elective	4 4
					15 (2) 16			15 (2) 16

FIFTH YEAR

TERM 13*			TERM 14			TERM 15		
	Elective	5 2½	20-24	Mon. & Bk.	4 4	20-25	Bus. Cycles	4 4
	Elective	5 2½	20-31	Ad. Ec. Theo.	4 4	20-32	Ad. Ec. Theo.	4 4
	Elective	5 2½		Elective	4 4		Elective	4 4
				Elective	4 4		Elective	4 4
			50-10	Place. Tech.	2 1			
		15 7½			18 17			16 16

Summer term — 5 weeks. () indicate laboratory hours.

All physically qualified male freshmen may elect ROTC if they so desire. Students accepted for the ROTC will not be required to take Physical Training in Terms 1, 2, 3, and will be permitted to substitute advanced ROTC courses for certain upperclass academic work as approved by the Dean up to a maximum of 12 credits.

Curriculum in English and English-Journalism

FIRST YEAR†

TERM 1				TERM 2				TERM 3		
No.	Course	Cl.	Cr.	No.	Course	Cl.	Cr.	No.	Course	Cl.
30-01	English	3	3	30-02	English	3	3	30-03	English	3
23-01	West Civ.	4	4	23-02	West. Civ.	4	4	23-03	West. Civ.	4
22-01	Am. Natl. Gov.	3	3	22-02	Am. Natl. Gov.	3	3	22-03	Am. Natl. Gov.	3
17-01	Surv. Sci.	3	3	17-02	Surv. Sci.	3	3	17-03	Surv. Sci.	3
	Mod. Lang.				Mod. Lang.				Mod. Lang.	
	Elective	3	3		Elective	3	3		Elective	3
16-10	Phys. Ed.	0 (2)	0	16-11	Phys. Ed.	0 (2)	0	16-12	Phys. Ed.	0 (2)
		<u>16</u>	<u>(2)</u>			<u>16</u>	<u>(2)</u>			<u>16</u>
		16				16				(2)

SECOND YEAR

TERM 4*				TERM 5				TERM 6			
17-04	Surv. Sci.	4	2	20-06	Ec. Prin. & Prob.	4	4	20-07	Ec. Prin. & Prob.	4	4
23-04	West. Civ.	4	2	23-17	Am. Hist.	4	4	23-18	Am. Hist.	4	4
	Mod. Lang.			30-33	Eng. Lit.	4	4	30-34	Eng. Lit.	4	4
	Elective	3	1½		Mod. Lang.				Mod. Lang.		
30-04	English	5	2½		Elective	4	4		Elective	4	4
		16	8			16	16			16	16

THIRD YEAR

TERM 7*				TERM 8				TERM 9			
Elective	5	2½	30-21	Inter. Writ.	4	4	30-22	Inter. Writ.	4	4	
Elective	5	2½	26-01	Prin. Soc. or	4	4	26-02	Prin. Soc. or	4	4	
Elective	5	2½	30-51	Int. Jour.	4	4	30-52	Int. Jour.	4	4	
				Elective	4	4		Elective	4	4	
				Elective	4	4		Elective	4	4	
	15	7½			16	16			16	16	

FOURTH YEAR

TERM 10*			TERM 11			TERM 12		
Elective	5	2½	30-29 Found. Eng.			30-30 Found. Eng.		
Elective	5	2½	Lang. or	4	4	Lang. or	4	4
Elective	5	2½	30-53 Tech. of Jour.	4	4	30-54 Tech. of Jour.	4	4
			30-35 Am. Lit.	4	4	30-36 Am. Lit.	4	4
			Elective	4	4	Elective	4	4
			Elective	4	4	Elective	4	4
	15	7½		16	16		16	16

FIFTH YEAR

TERM 13*				TERM 14				TERM 15			
Elective	5	2½		30-43	19th Cen. Pr.	4	4	30-44	19th Cen. Pr.	4	4
Elective	5	2½		30-61	Shakespeare	4	4	30-62	Shakespeare	4	4
Elective	5	2½			Elective	4	4		Elective	4	4
					Elective	4	4		Elective	4	4
				50-10	Place. Tech.	2	1				
	15	7½				18	17			16	

*Summer term — 5 weeks.

() indicate laboratory hours.

†All physically qualified male freshmen may elect ROTC if they so desire. Students accepted for the ROTC will not be required to take Physical Training in Terms 1, 2, 3, and will be permitted to substitute advanced ROTC courses for certain upperclass academic work as approved by the Dean up to a maximum of credits.

Curriculum in History-Government

FIRST YEAR†

TERM 1			TERM 2			TERM 3		
No.	Course	Cl. Cr.	No.	Course	Cl. Cr.	No.	Course	Cl. Cr.
0-01	English	3 3	30-02	English	3 3	30-03	English	3 3
3-01	West. Civ.	4 4	23-02	West. Civ.	4 4	23-03	West. Civ.	4 4
2-01	Am. Natl. Gov.	3 3	22-02	Am. Natl. Gov.	3 3	22-03	Am. Natl. Gov.	3 3
7-01	Surv. Sci.	3 3	17-02	Surv. Sci.	3 3	17-03	Surv. Sci.	3 3
	Mod. Lang.			Mod. Lang.			Mod. Lang.	
	Elective	3 3		Elective	3 3		Elective	3 3
6-10	Phys. Ed.	0 (2) 0	16-11	Phys. Ed.	0 (2) 0	16-12	Phys. Ed.	0 (2) 0
		16 (2) 16			16 (2) 16			16 (2) 16

SECOND YEAR

TERM 4*			TERM 5			TERM 6		
No.	Course	Cl. Cr.	No.	Course	Cl. Cr.	No.	Course	Cl. Cr.
7-04	Surv. Sci.	4 2	20-06	Ec. Prin. & Prob.	4 4	20-07	Ec. Prin. & Prob.	4 4
3-04	West. Civ.	4 2	23-17	Am. Hist.	4 4	23-18	Am. Hist.	4 4
	Mod. Lang.		30-33	Eng. Lit.	4 4	30-34	Eng. Lit.	4 4
	Elective	3 1½		Mod. Lang.			Mod. Lang.	
0-04	English	5 2½		Elective	4 4		Elective	4 4
		16 8			16 16			16 16

THIRD YEAR

TERM 7*			TERM 8			TERM 9		
No.	Course	Cl. Cr.	No.	Course	Cl. Cr.	No.	Course	Cl. Cr.
	Elective	5 2½	22-11	For. Gov.	4 4	22-12	For. Gov.	4 4
	Elective	5 2½	23-11	Eur. Hist.	4 4	23-12	Eur. Hist.	4 4
	Elective	5 2½		Elective	4 4		Elective	4 4
		15 7½		Elective	4 4		Elective	4 4
					16 16			16 16

FOURTH YEAR

TERM 10*			TERM 11			TERM 12		
No.	Course	Cl. Cr.	No.	Course	Cl. Cr.	No.	Course	Cl. Cr.
	Elective	5 2½	22-13	Pol. Theory	4 4	22-14	Pol. Theory	4 4
	Elective	5 2½	23-13	Eng. Hist.	4 4	23-14	Eng. Hist.	4 4
	Elective	5 2½		Elective	4 4		Elective	4 4
		15 7½		Elective	4 4		Elective	4 4
					16 16			16 16

FIFTH YEAR

TERM 13*			TERM 14			TERM 15		
No.	Course	Cl. Cr.	No.	Course	Cl. Cr.	No.	Course	Cl. Cr.
	Elective	5 2½	22-20	Pub. Adm.	4 4	22-21	Pub. Adm.	4 4
	Elective	5 2½		or			or	
	Elective	5 2½	23-09	Anc. Greece	4 4	23-10	Anc. Rome	4 4
			22-17	Int. Pol.	4 4	22-18	Int. Org.	4 4
				or			or	
			23-19	Lat. Am. His.	4 4	23-20	Lat. Am. His.	4 4
				Elective	4 4		Elective	4 4
				Elective	4 4		Elective	4 4
			50-10	Place. Tech.	2 1			
		15 7½			18 17			16 16

Summer term — 5 weeks. () indicate laboratory hours.

All physically qualified male freshmen may elect ROTC if they so desire. Students accepted for the ROTC will not be required to take Physical Training in Terms 1, 2, 3, and will be permitted to substitute advanced ROTC courses for certain upperclass academic work as approved by the Dean up to a maximum of 12 credits.

Curriculum in Mathematics

FIRST YEAR†

TERM 1			TERM 2			TERM 3		
No.	Course	Cl. Cr.	No.	Course	Cl. Cr.	No.	Course	Cl. Cr.
30-01	English	3 3	30-02	English	3 3	30-03	English	3 3
11-01	Gen. Chem.	3 (3) 4	11-02	Gen. Chem.	3 (3) 4	11-03	Gen. Chem.	3 (3) 4
14-61	Math. I	5 4	14-62	Math. II	5 4	14-63	Math. III	5 4
15-51	Physics	3 3	15-52	Physics	3 3	15-53	Physics	3 3
	Mod. Lang.			Mod. Lang.			Mod. Lang.	
	Elective	3 3		Elective	3 3		Elective	3 3
16-10	Phys. Ed.	0 (2) 0	16-11	Phys. Ed.	0 (2) 0	16-12	Phys. Ed.	0 (2) 0
		17 (5) 17			17 (5) 17			17 (5) 17

SECOND YEAR

TERM 4*			TERM 5			TERM 6		
No.	Course	Cl. Cr.	No.	Course	Cl. Cr.	No.	Course	Cl. Cr.
11-04	Gen. Chem.	3 (3) 2	30-33	Eng. Lit.	4 4	30-34	Eng. Lit.	4 4
14-64	Math. IV	5 2½	14-05	Diff. Calc.	4 4	14-06	Int. Calc.	4 4
15-54	Physics	5 2½	15-05	Physics	4 (3) 5	15-06	Physics	3 (3) 4
	Mod. Lang.			Mod. Lang.			Mod. Lang.	
	Elective	3 1½		Elective	4 4		Elective	4 4
		16 (3) 8½			16 (3) 17			15 (3) 11

THIRD YEAR

TERM 7*			TERM 8			TERM 9		
No.	Course	Cl. Cr.	No.	Course	Cl. Cr.	No.	Course	Cl. Cr.
	Elective	5 2½	14-07	Diff. Equa. I	4 4	14-08	Diff. Equa. II	4 4
	Elective	5 2½	14-31	Geometries	4 4	14-17	Inf. Series	4 4
	Elective	5 2½		Elective	4 4		Elective	4 4
		15 7½		Elective	4 4		Elective	4 4
					16 16			16 11

FOURTH YEAR

TERM 10*			TERM 11			TERM 12		
No.	Course	Cl. Cr.	No.	Course	Cl. Cr.	No.	Course	Cl. Cr.
	Elective	5 2½	14-15	Adv. Calc.	4 4	14-16	Adv. Calc.	4 4
	Elective	5 2½	15-17	Mechanics	4 4	15-18	Mechanics	4 4
	Elective	5 2½		Elective	4 4		Elective	4 4
		15 7½		Elective	4 4		Elective	4 4
					16 16			16 11

FIFTH YEAR

TERM 13*			TERM 14			TERM 15		
No.	Course	Cl. Cr.	No.	Course	Cl. Cr.	No.	Course	Cl. Cr.
	Elective	5 2½		Math. Elec.	4 4		Math. Elec.	4 4
	Elective	5 2½	14-28	Math. Stat.	4 4	14-29	Math. Stat.	4 4
	Elective	5 2½		Elective	4 4		Elective	4 4
		15 7½		Elective	4 4		Elective	4 4
			50-10	Place. Tech.	2 1			16 11
					18 17			

*Summer term — 5 weeks. () indicate laboratory hours.

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Curriculum in Modern Languages

FIRST YEAR†

TERM 1			TERM 2			TERM 3		
No.	Course	Cl. Cr.	No.	Course	Cl. Cr.	No.	Course	Cl. Cr.
1-01	English	3 3	30-02	English	3 3	30-03	English	3 3
1-01	West. Civ.	4 4	23-02	West. Civ.	4 4	23-03	West. Civ.	4 4
1-01	Am. Natl. Gov.	3 3	22-02	Am. Natl. Gov.	3 3	22-03	Am. Natl. Gov.	3 3
1-01	Surv. Sci.	3 3	17-02	Surv. Sci.	3 3	17-03	Surv. Sci.	3 3
	Mod. Lang.			Mod. Lang.			Mod. Lang.	
	Elective	3 3		Elective	3 3		Elective	3 3
1-10	Phys. Ed.	0 (2) 0	16-11	Phys. Ed.	0 (2) 0	16-12	Phys. Ed.	0 (2) 0
		16 (2) 16			16 (2) 16			16 (2) 16

SECOND YEAR

TERM 4*			TERM 5			TERM 6		
No.	Course	Cl. Cr.	No.	Course	Cl. Cr.	No.	Course	Cl. Cr.
1-04	Surv. Sci.	4 2	20-06	Ec. Prin. & Prob.	4 4	20-07	Ec. Prin. & Prob.	4 4
1-04	West. Civ.	4 2	23-17	Am. Hist.	4 4	23-18	Am. Hist.	4 4
	Mod. Lang.		30-33	Eng. Lit.	4 4	30-34	Eng. Lit.	4 4
	Elective	3 1½		Mod. Lang.			Mod. Lang.	
1-04	English	5 2½		Elective	4 4		Elective	4 4
		16 8			16 16			16 16

THIRD YEAR

TERM 7*			TERM 8			TERM 9		
No.	Course	Cl. Cr.	No.	Course	Cl. Cr.	No.	Course	Cl. Cr.
	Elective	5 2½	31-21	Fr. Lit.	4 4	31-22	Fr. Lit.	4 4
	Elective	5 2½	32-21	Ger. Lit. or	4 4	32-22	Ger. Lit. or	4 4
	Elective	5 2½	33-21	Span. Lit.	4 4	33-22	Span. Lit.	4 4
			31-17	Fr. Conv.	2 2	31-18	Fr. Conv.	2 2
				Elective	4 4		Elective	4 4
				Elective	4 4		Elective	4 4
		15 7½			18 18			18 18

FOURTH YEAR

TERM 10*			TERM 11			TERM 12		
No.	Course	Cl. Cr.	No.	Course	Cl. Cr.	No.	Course	Cl. Cr.
	Elective	5 2½	31-23	Fr. Class.	4 4	31-24	Fr. Class.	4 4
	Elective	5 2½	32-23	Ger. Lit. or	4 4	32-24	Ger. Lit. or	4 4
	Elective	5 2½	33-23	Span. Lit.	4 4	33-24	Span. Lit.	4 4
			32-17	Ger. Conv. or	2 2	32-18	Ger. Conv. or	2 2
			33-17	Span. Conv.	2 2	33-18	Span. Conv.	2 2
				Elective	4 4		Elective	4 4
				Elective	4 4		Elective	4 4
		15 7½			18 18			18 18

FIFTH YEAR

TERM 13*			TERM 14			TERM 15		
No.	Course	Cl. Cr.	No.	Course	Cl. Cr.	No.	Course	Cl. Cr.
	Elective	5 2½	31-25	Fr. Rom.	4 4	31-26	Fr. Rom.	4 4
	Elective	5 2½	32-25	Ger. Lit. or	4 4	32-26	Ger. Lit. or	4 4
	Elective	5 2½	33-25	Span. Lit.	4 4	33-26	Span. Lit.	4 4
				Elective	4 4		Elective	4 4
				Elective	4 4		Elective	4 4
			50-10	Place. Tech.	2 1			
		15 7½			18 17			16 16

Summer term — 5 weeks. () indicate laboratory hours.

All physically qualified male freshmen may elect ROTC if they so desire. Students accepted for the ROTC will not be required to take Physical Training in Terms 1, 2, 3, and will be permitted to substitute advanced ROTC courses for certain upperclass academic work as approved by the Dean up to a maximum of 12 credits.

Curriculum in Physics

FIRST YEAR†

TERM 1			TERM 2			TERM 3		
No.	Course	Cl. Cr.	No.	Course	Cl. Cr.	No.	Course	Cl. Cr.
30-01	English	3 3	30-02	English	3 3	30-03	English	3 3
11-01	Gen. Chem.	3 (3) 4	11-02	Gen. Chem.	3 (3) 4	11-03	Gen. Chem.	3 (3) 4
14-61	Math. I	5 4	14-62	Math. II	5 4	14-63	Math. III	5 4
15-51	Physics	3 3	15-52	Physics	3 3	15-53	Physics	3 3
	Mod. Lang.			Mod. Lang.			Mod. Lang.	
	Elective	3 3		Elective	3 3		Elective	3 3
16-10	Phys. Ed.	0 (2) 0	16-11	Phys. Ed.	0 (2) 0	16-12	Phys. Ed.	0 (2) 0
		17 (5) 17			17 (5) 17			17 (5) 17

SECOND YEAR

TERM 4*			TERM 5			TERM 6		
No.	Course	Cl. Cr.	No.	Course	Cl. Cr.	No.	Course	Cl. Cr.
11-04	Gen. Chem.	3 (3) 2	30-33	Eng. Lit.	4 4	30-34	Eng. Lit.	4 4
14-64	Math. IV	5 2½	14-05	Diff. Calc.	4 4	14-06	Int. Calc.	4 4
15-54	Physics	5 2½	15-05	Physics	4 (3) 5	15-06	Physics	3 (3) 4
	Mod. Lang.			Mod. Lang.			Mod. Lang.	
	Elective	3 1½		Elective	4 4		Elective	4 4
		16 (3) 8½			16 (3) 17			15 (3) 15

THIRD YEAR

TERM 7*			TERM 8			TERM 9		
No.	Course	Cl. Cr.	No.	Course	Cl. Cr.	No.	Course	Cl. Cr.
	Elective	5 2½	15-16	Elect. & Mag.	3 3	15-24	Electronics	3 (3) 4
	Elective	5 2½	15-17	Mechanics	4 4	15-18	Mechanics	4 4
	Elective	5 2½	14-07	Diff. Equa. I	4 4	14-08	Diff. Equa. II	4 4
				Lib. Elec.	4 4		Lib. Elec.	4 4
		15 7½			15 15			15 (3) 15

FOURTH YEAR

TERM 10*			TERM 11			TERM 12		
No.	Course	Cl. Cr.	No.	Course	Cl. Cr.	No.	Course	Cl. Cr.
	Elective	5 2½	15-26	Mod. Physics	4 4	15-27	Mod. Physics	4 4
	Elective	5 2½	15-20	Optics	3 (3) 4	15-21	Optics	3 (3) 4
	Elective	5 2½		Math. Elec.	4 4		Math. Elec.	4 4
				Lib. Elec.	4 4		Lib. Elec.	4 4
		15 7½			15 (3) 16			15 (3) 15

FIFTH YEAR

TERM 13*			TERM 14			TERM 15		
No.	Course	Cl. Cr.	No.	Course	Cl. Cr.	No.	Course	Cl. Cr.
	Elective	5 2½	15-31	Nucl. Physics	4 4	15-32	Nucl. Physics	4 4
	Elective	5 2½	15-33	Quant. Mech.	4 4	15-34	Quant. Mech.	4 4
				or			or	
			15-25	Electronics	3 (3) 4	15-28	El. Instr.	2 (4) 4
				Math. Elective	4 4		Math. Elective	4 4
				Elective	4 4		Elective	4 4
			50-10	Place. Tech.	2 1			
		15 7½			18 17			16 16
				or	17 (3) 17			or 14 (4)

*Summer term — 5 weeks. () indicate laboratory hours.

†All physically qualified male freshmen may elect ROTC if they so desire. Students accepted for the ROTC will not be required to take Physical Training in Terms 1, 2, 3, and will be permitted to substitute advanced ROTC courses for certain upperclass academic work as approved by the Dean up to a maximum of credits.

Two-Year Predental Curriculum

FIRST YEAR†

TERM 1			TERM 2			TERM 3		
No.	Course	Cl. Cr.	No.	Course	Cl. Cr.	No.	Course	Cl. Cr.
0-01	English	3 3	30-02	English	3 3	30-03	English	3 3
1-01	Gen. Chem.	3 (3) 4	11-02	Gen. Chem.	3 (3) 4	11-03	Gen. Chem.	3 (3) 4
4-21	Basic Math.	3 3	14-22	Basic Math.	3 3	14-23	Basic Math.	3 3
0-01	Gen. Biol.	2 (3) 3	10-02	Gen. Biol.	2 (3) 3	10-03	Gen. Biol.	2 (3) 3
	Mod. Lang.			Mod. Lang.			Mod. Lang.	
	Elective	3 3		Elective	3 3		Elective	3 3
6-10	Phys. Ed.	0 (2) 0	16-11	Phys. Ed.	0 (2) 0	16-12	Phys. Ed.	0 (2) 0
		14 (8) 16			14 (8) 16			14 (8) 16

SECOND YEAR

TERM 4*			TERM 5			TERM 6		
0-04	Gen. Biol.	3 (3) 2	10-55	Comp. Anat.	3 (3) 4	10-56	Comp. Anat.	3 (3) 4
1-05	Gen. Chem.	3 (3) 2	11-26	Org. Chem.	3 (3) 4	11-27	Org. Chem.	3 (3) 4
5-11	Gen. Phys.	6 3	15-12	Gen. Phys.	3 (3) 5	15-13	Gen. Phys.	3 (3) 5
	Mod. Lang.			Mod. Lang.			Mod. Lang.	
	Elective	3 1½		Elective	4 4		Elective	4 4
		15 (6) 8½			13 (9) 17			13 (9) 17

TERM 5-A

10-40	Physiology	3 (3) 4
	Eng. Elect.	4 4
	Elective	4 4
	Elective	4 4
		15 (3) 16

NOTE: Predental students who wish to continue for a degree may be excused from the Co-operative Plan and may complete requirements for a degree in four years, or may take a third year to qualify for a degree under the Combined Program described on page 70.

Summer term — 5 weeks. () indicate laboratory hours.

All physically qualified male freshmen may elect ROTC if they so desire. Students accepted for the ROTC will not be required to take Physical Training in Terms 1, 2, 3, and will be permitted to substitute advanced ROTC courses for certain upperclass academic work as approved by the Dean up to a maximum of 12 credits.

Prelegal Curriculum

FIRST YEAR†

TERM 1			
No.	Course	Cl.	Cr.
30-01	English	3	3
23-01	West. Civ.	4	4
22-01	Am. Natl. Gov.	3	3
17-01	Surv. Sci.	3	3
	Mod. Lang.		
	Elective	3	3
16-10	Phys. Ed.	0 (2)	0
		16	(2) 16

TERM 2			
No.	Course	Cl.	Cr.
30-02	English	3	3
23-02	West. Civ.	4	4
22-02	Am. Natl. Gov.	3	3
17-02	Surv. Sci.	3	3
	Mod. Lang.		
	Elective	3	3
16-11	Phys. Ed.	0 (2)	0
		16	(2) 16

TERM 3			
No.	Course	Cl.	Cr.
30-03	English	3	3
23-03	West. Civ.	4	4
22-03	Am. Natl. Gov.	3	3
17-03	Surv. Sci.	3	3
	Mod. Lang.		
	Elective	3	3
16-12	Phys. Ed.	0 (2)	0
		16	(2) 16

SECOND YEAR

TERM 4*			
No.	Course	Cl.	Cr.
17-04	Surv. Sci.	4	2
23-04	West. Civ.	4	2
	Mod. Lang.		
	Elective	3	1½
30-04	English	5	2½
		16	8

TERM 5			
No.	Course	Cl.	Cr.
20-06	Ec. Prin. & Prob.	4	4
23-17	Am. Hist.	4	4
30-33	Eng. Lit.	4	4
	Mod. Lang.		
	Elective	4	4
		16	16

TERM 6			
No.	Course	Cl.	Cr.
20-07	Ec. Prin. & Prob.		4
23-18	Am. Hist.		4
30-34	Eng. Lit.		4
	Mod. Lang.		
	Elective		4
		16	16

TERM 5-A			
No.	Course	Cl.	Cr.
25-01	Intro. Psych.	4	4
26-01	Prin. Soc.	4	4
	Elective	4	4
	Elective	3	3
		15	15

THIRD YEAR

TERM 8			
No.	Course	Cl.	Cr.
22-11	For. Gov.	4	4
23-13	Eng. Hist.	4	4
29-01	Public Speaking	4	4
	Elective	4	4
		16	16

TERM 8-A			
No.	Course	Cl.	Cr.
	Gov. Elect.	4	4
	Hist. Elect.	4	4
	Elective	4	4
	Elective	4	4
	Elective	4	4
		20	20

TERM 9			
No.	Course	Cl.	Cr.
22-12	For. Gov.		4
23-14	Eng. Hist.		4
29-02	Public Speaking		4
	Elective		4
		16	16

NOTE: Prelegal students who have completed the above program may qualify for the A.B. degree under the Combined Program described on page 70 or by continuing for a fourth year as a History-Government major.

*Summer term — 5 weeks. () indicate laboratory hours.

†All physically qualified male freshmen may elect ROTC if they so desire. Students accepted for the ROTC will not be required to take Physical Training in Terms 1, 2, 3, and will be permitted to substitute advanced ROTC courses for certain upperclass academic work as approved by the Dean up to a maximum of 1 credits.

Premedical Curriculum

FIRST YEAR†

TERM 1			TERM 2			TERM 3		
No.	Course	Cl. Cr.	No.	Course	Cl. Cr.	No.	Course	Cl. Cr.
0-01	English	3 3	30-02	English	3 3	30-03	English	3 3
1-01	Gen. Chem.	3 (3) 4	11-02	Gen. Chem.	3 (3) 4	11-03	Gen. Chem.	3 (3) 4
1-21	Basic Math.	3 3	14-22	Basic Math.	3 3	14-23	Basic Math.	3 3
1-01	Gen. Biol.	2 (3) 3	10-02	Gen. Biol.	2 (3) 3	10-03	Gen. Biol.	2 (3) 3
	Mod. Lang.			Mod. Lang.			Mod. Lang.	
	Elective	3 3		Elective	3 3		Elective	3 3
5-10	Phys. Ed.	0 (2) 0	16-11	Phys. Ed.	0 (2) 0	16-12	Phys. Ed.	0 (2) 0
		14 (8) 16			14 (8) 16			14 (8) 16

SECOND YEAR

TERM 4*			TERM 5			TERM 6		
No.	Course	Cl. Cr.	No.	Course	Cl. Cr.	No.	Course	Cl. Cr.
1-04	Gen. Biol.	3 (3) 2	10-55	Comp. Anat.	3 (3) 4	10-56	Comp. Anat.	3 (3) 4
1-05	Gen. Chem.	3 (3) 2	11-26	Org. Chem.	3 (3) 4	11-27	Org. Chem.	3 (3) 4
5-11	Gen. Phys.	6 3	15-12	Gen. Phys.	3 (3) 5	15-13	Gen. Phys.	3 (3) 5
	Mod. Lang.			Mod. Lang.			Mod. Lang.	
	Elective	3 1½		Elective	4 4		Elective	4 4
		15 (6) 8½			13 (9) 17			13 (9) 17

THIRD YEAR

TERM 7*			TERM 8			TERM 9		
No.	Course	Cl. Cr.	No.	Course	Cl. Cr.	No.	Course	Cl. Cr.
	Elective	5 2½	10-40	Physiology	3 (3) 4	10-41	Physiology	3 (3) 4
	Elective	5 2½	11-28	Org. Chem.	4 (3) 5		Elective	4 4
	Elective	5 2½		Elective	4 4		Elective	4 4
		15 7½		Elective	4 4		Elective	4 4
					15 (6) 17			15 (3) 16

FOURTH YEAR

TERM 10*			TERM 11			TERM 12		
No.	Course	Cl. Cr.	No.	Course	Cl. Cr.	No.	Course	Cl. Cr.
	Elective	5 2½	10-61	Embryology	3 (3) 4	10-62	Embryology	3 (3) 4
	Elective	5 2½	11-17	Quant. Anal.	3 (3) 4	11-18	Quant. Anal.	2 (3) 3
	Elective	5 2½		Elective	4 4		Elective	4 4
		15 7½		Elective	4 4		Elective	4 4
					14 (6) 16			13 (6) 15

FIFTH YEAR

TERM 13*			TERM 14			TERM 15		
No.	Course	Cl. Cr.	No.	Course	Cl. Cr.	No.	Course	Cl. Cr.
	Elective	5 2½		Bio. Elec.	4 4		Bio. Elec.	4 4
	Elective	5 2½		Elective	4 4		Elective	4 4
	Elective	5 2½		Elective	4 4		Elective	4 4
		15 7½		Elective	4 4		Elective	4 4
					16 16			16 16

NOTE: Premedical students may be excused from the Co-operative Plan and may complete this program in four years, or after three years may take advantage of the Combined Program described on page 70.

Summer term — 5 weeks. () indicate laboratory hours.

All physically qualified male freshmen may elect ROTC if they so desire. Students accepted for the ROTC will not be required to take Physical Training in Terms 1, 2, 3, and will be permitted to substitute advanced ROTC courses for certain upperclass academic work as approved by the Dean up to a maximum of 12 credits.

Three-Year Premedical Technology Curriculum

FIRST YEAR†

TERM 1			TERM 2			TERM 3		
No.	Course	Cl. Cr.	No.	Course	Cl. Cr.	No.	Course	Cl. Cr.
30-01	English	3 3	30-02	English	3 3	30-03	English	3 3
11-01	Gen. Chem.	3 (3) 4	11-02	Gen. Chem.	3 (3) 4	11-03	Gen. Chem.	3 (3) 4
14-21	Basic Math.	3 3	14-22	Basic Math.	3 3	14-23	Basic Math.	3 3
10-01	Gen. Biol.	2 (3) 3	10-02	Gen. Biol.	2 (3) 3	10-03	Gen. Biol.	2 (3) 3
	Mod. Lang.			Mod. Lang.			Mod. Lang.	
	Elective	3 3		Elective	3 3		Elective	3 3
16-10	Phys. Ed.	0 (2) 0	16-11	Phys. Ed.	0 (2) 0	16-12	Phys. Ed.	0 (2) 0
		14 (8) 16			14 (8) 16			14 (8) 16

SECOND YEAR

TERM 4*			TERM 5			TERM 6		
No.	Course	Cl. Cr.	No.	Course	Cl. Cr.	No.	Course	Cl. Cr.
10-04	Gen. Biol.	3 (3) 2	10-20	Gen. Bact.	3 (3) 4	10-21	Gen. Bact.	3 (3) 4
11-05	Gen. Chem.	3 (3) 2	10-55	Comp. Anat.	3 (3) 4	10-56	Comp. Anat.	3 (3) 4
30-04	Int. to Lit.	5 2½	11-26	Org. Chem.	3 (3) 4	11-27	Org. Chem.	3 (3) 4
	Mod. Lang.			Mod. Lang.			Mod. Lang.	
	Elective	3 1½		Elective	4 4		Elective	4 4
		14 (6) 8			13 (9) 16			13 (9) 16

TERM 5-A		
No.	Course	Cl. Cr.
10-40	Physiology	3 (3) 4
	Elective	4 4
	Elective	4 4
	Elective	4 4
		15 (3) 16

THIRD YEAR

TERM 8			TERM 8-A			TERM 9		
No.	Course	Cl. Cr.	No.	Course	Cl. Cr.	No.	Course	Cl. Cr.
11-28	Org. Chem.	4 (3) 5		Elective	4 4	11-45	Biol. Chem.	4 4
10-59	An. Histol.	3 (3) 4		Elective	4 4	10-41	Physiology	3 (3) 4
	Elective	4 4		Elective	4 4	10-60	An. Histol.	3 (3) 4
	Elective	4 4		Elective	4 4		Elective	4 4
		15 (6) 17			16 16			14 (6) 16

NOTE: Students who enter an approved hospital school of medical technology after the above program and satisfactorily complete the year course will be allowed 24 credit hours of work toward the B.S. degree upon the return to Northeastern. They will be able to qualify for the degree after one year on the Co-operative Plan.

*Summer term — 5 weeks. () indicate laboratory hours.

†All physically qualified male freshmen may elect ROTC if they so desire. Students accepted for the ROTC will not be required to take Physical Training in Terms 1, 2, 3, and will be permitted to substitute advanced ROTC courses for certain upperclass academic work as approved by the Dean up to a maximum of 12 credits.

Curriculum in Psychology

FIRST YEAR†

TERM 1			TERM 2			TERM 3		
No.	Course	Cl. Cr.	No.	Course	Cl. Cr.	No.	Course	Cl. Cr.
0-01	English	3 3	30-02	English	3 3	30-03	English	3 3
3-01	West. Civ.	4 4	23-02	West. Civ.	4 4	23-03	West. Civ.	4 4
4-21	Basic Math.	3 3	14-22	Basic Math.	3 3	14-23	Basic Math.	3 3
0-01	Gen. Biol.	2 (3) 3	10-02	Gen. Biol.	2 (3) 3	10-03	Gen. Biol.	2 (3) 3
	Mod. Lang.			Mod. Lang.			Mod. Lang.	
	Elective	3 3		Elective	3 3		Elective	3 3
5-10	Phys. Ed.	0 (2) 0	16-11	Phys. Ed.	0 (2) 0	16-12	Phys. Ed.	0 (2) 0
		15 (5) 16			15 (5) 16			15 (5) 16

SECOND YEAR

TERM 4*			TERM 5			TERM 6		
0-04	Gen. Biol.	3 (3) 2	20-06	Ec. Prin. & Prob.	4 4	20-07	Ec. Prin. & Prob.	4 4
3-04	West. Civ.	4 2	25-01	Intro. Psych.	4 4	25-02	Gen. Psych.	4 4
	Mod. Lang.		26-01	Prin. Soc.	4 4	26-02	Prin. Soc.	4 4
	Elective	3 1½		Mod. Lang.			Mod. Lang.	
0-04	English	5 2½		Elective	4 4		Elective	4 4
		15 (3) 8			16 16			16 16

THIRD YEAR

TERM 7*			TERM 8			TERM 9		
Elective	5	2½	25-09	Statistics	4 4	25-10	Statistics	4 4
Elective	5	2½	25-12	Exp. Psych.	3 (3) 4	25-13	Exp. Psych.	3 (3) 4
Elective	5	2½		Elective	4 4		Elective	4 4
		15 7½		Elective	4 4		Elective	4 4
					15 (3) 16			15 (3) 16

FOURTH YEAR

TERM 10*			TERM 11			TERM 12		
Elective	5	2½	25-17	Measurements	4 4	25-14	Exp. Psych.	3 (3) 4
Elective	5	2½	25-34	Child Psych.	4 4	25-37	Child Psych.	4 4
Elective	5	2½		Elective	4 4		Elective	4 4
		15 7½		Elective	4 4		Elective	4 4
					16 16			15 (3) 16

FIFTH YEAR

TERM 13*			TERM 14			TERM 15		
Elective	5	2½	25-31	Ab. Psych.	4 4	25-32	Ab. Psych.	4 4
Elective	5	2½	25-41	Adv. Psych.	4 4	25-42	Adv. Psych.	4 4
Elective	5	2½		Elective	4 4		Elective	4 4
				Elective	4 4		Elective	4 4
			50-10	Place. Tech.	2 1			
		15 7½			18 17			16 16

Summer term — 5 weeks. () indicate laboratory hours.

All physically qualified male freshmen may elect ROTC if they so desire. Students accepted for the ROTC will not be required to take Physical Training in Terms 1, 2, 3, and will be permitted to substitute advanced ROTC courses for certain upperclass academic work as approved by the Dean up to a maximum of 12 credits.

Curriculum in Sociology

FIRST YEAR†

TERM 1			TERM 2			TERM 3		
No.	Course	Cl. Cr.	No.	Course	Cl. Cr.	No.	Course	Cl. Cr.
30-01	English	3 3	30-02	English	3 3	30-03	English	3 3
23-01	West. Civ.	4 4	23-02	West. Civ.	4 4	23-03	West. Civ.	4 4
22-01	Am. Natl. Gov.	3 3	22-02	Am. Natl. Gov.	3 3	22-03	Am. Natl. Gov.	3 3
17-01	Surv. Sci.	3 3	17-02	Surv. Sci.	3 3	17-03	Surv. Sci.	3 3
	Mod. Lang.			Mod. Lang.			Mod. Lang.	
	Elective	3 3		Elective	3 3		Elective	3 3
16-10	Phys. Ed.	0 (2) 0	16-11	Phys. Ed.	0 (2) 0	16-12	Phys. Ed.	0 (2) 0
		16 (2) 16			16 (2) 16			16 (2) 16

SECOND YEAR

TERM 4*			TERM 5			TERM 6		
17-04	Surv. Sci.	4 2	20-06	Ec. Prin. & Prob.	4 4	20-07	Ec. Prin. & Prob.	4 4
23-04	West. Civ.	4 2	25-01	Intro. Psych.	4 4	25-02	Gen. Psych.	4 4
	Mod. Lang.		26-01	Prin. Soc.	4 4	26-02	Prin. Soc.	4 4
	Elective	3 1½		Mod. Lang.			Mod. Lang.	
30-04	English	5 2½		Elective	4 4		Elective	4 4
		16 8			16 16			16 16

THIRD YEAR

TERM 7*			TERM 8			TERM 9		
Elective	5 2½		26-08	Comp. Culture	4 4	26-09	Am. Culture	4 4
Elective	5 2½			Elective	4 4		Elective	4 4
Elective	5 2½			Elective	4 4		Elective	4 4
	15 7½			Elective	4 4		Elective	4 4
					16 16			16 16

FOURTH YEAR

TERM 10*			TERM 11			TERM 12		
Elective	5 2½		26-11	Soc. Prob.	4 4	26-12	Ind. & Soc.	4 4
Elective	5 2½		26-16	Criminology	4 4	26-17	Urban Soc.	4 4
Elective	5 2½			Elective	4 4		Elective	4 4
	15 7½			Elective	4 4		Elective	4 4
					16 16			16 16

FIFTH YEAR

TERM 13*			TERM 14			TERM 15		
Elective	5 2½		26-19	Soc. Theory	4 4	26-20	Soc. Theory	4 4
Elective	5 2½			Soc. Elective	4 4		Soc. Elective	4 4
Elective	5 2½			Elective	4 4		Elective	4 4
	15 7½			Elective	4 4		Elective	4 4
			50-10	Place. Tech.	2 1			16 16
					18 17			

*Summer term — 5 weeks. () indicate laboratory hours.

†All physically qualified male freshmen may elect ROTC if they so desire. Students accepted for the ROTC will not be required to take Physical Training in Terms 1, 2, 3, and will be permitted to substitute advanced ROTC courses for certain upperclass academic work as approved by the Dean up to a maximum of 6 credits.

THE COLLEGE OF EDUCATION

General Objectives

THE WIDESPREAD ANXIETY, insecurity, and confusion present in the world suggest a need for teachers who can guide students (1) in making sense in apparent chaos, (2) in defining and attacking urgent problems appropriate to their level of development, and (3) in mastering a variety of skills and insights for purposes of effective adjustment with their total environment. Teachers today must know more about more things than ever before. In addition, they must be able to utilize such knowledge so that understanding grows into the nervous systems of students. Appropriate value judgments will then become an integrating aspect of living.

In order to achieve this, teachers in our elementary and secondary schools must be excellent examples of free men functioning in a free society, must be intelligent, emotionally controlled and flexible, healthy, and creative. Teachers should like people without being emotionally dependent upon them. They must be convinced of the power of education and a teacher's value to society.

To prepare such teachers, Northeastern University will require (1) that a considerable portion of the student's time be devoted to a broad general education, (2) that a student know thoroughly his major field of study, and (3) that he have a series of vital professional experiences before being declared competent to teach. Consistent with sound learning, best judgment, and the established policy of the University, the College of Education will attempt to correlate in these professional experiences practice and theory.

It is the purpose of the College to adapt its programs to meet the individual needs of the students whom it serves and thus to contribute in a significant way to the increase in numbers and effectiveness of the teachers who will be needed for the education of the constantly growing school population.

All information available suggests that there will be a continuing need for teachers in the elementary schools of the nation for many years. In addition, there are critical shortages of science and mathematics teachers. By 1960, due largely to the expanded enrollments in the high schools, teachers in nearly every field will be needed.

This catalog deals chiefly with the undergraduate curricula of the College which are designed for young men and women coming directly from high school or returning from the armed services. Teachers who are interested in the graduate program may obtain the circular outlining these courses from the Dean of the College.

Admission Requirements

Applicants for admission to the freshman class must qualify by graduation from an accredited secondary school or the equivalent, including prescribed subjects listed on page 29.

Requirements for Graduation

Degrees

The College of Education will award the degree of Bachelor of Science in Education to those who successfully complete the program of preparation for teaching at elementary or secondary school levels.

Quantitative Requirements

The required courses in each of the undergraduate curricula in the College of Education are indicated on the following pages. Each curriculum normally provides for not less than 214 credit hours of classwork including 20 weeks of student teaching. At least 36 credit hours will be required in Education, including student teaching.

Elective Courses

Elective courses, approved by the Dean of the College of Education, will be selected by the student from among courses in the Colleges of Liberal Arts and Business Administration.

Qualitative Requirements

The degree conferred does not necessarily represent professional competence but merely the formal completion of the subjects in the selected course of study. Students in the College of Education will be expected, therefore, to maintain an overall average of C while doing work of C+ or better in the field of specialization and in the professional sequence in order to be recommended for placement. Students are warned that any failure seriously handicaps their records and must be made up in the academic year the failure occurs.

Graduation with Honors

Candidates who have achieved distinctly superior attainment in their academic work will be graduated with honor. Upon special vote of the faculty a limited number of this group may be graduated with high honor or with highest honor. Students must have been in attendance at the University at least three years before they may become eligible for honors at graduation.

Co-operative Plan

Students in the College of Education upon successfully completing thirty-five weeks of academic work are urged to elect the Co-operative Plan. In this program periods of classroom work alternate with a variety of work experiences in

industry, social service agencies, community organizations, etc. This program, which has proved to be of inestimable value in offering students both the theoretical and practical aspects of a broad education, is consistent with the philosophy of the College of Education. Increasingly students may find opportunities for employment in school systems during several terms of their upper years. Such an internship program will greatly enhance their confidence and effectiveness as teachers and increase the demand for their services after graduation.

Full-time Students

Students desiring to attend the College of Education on the traditional four-year plan will be required to attend 40 weeks in both their junior and senior years. The third year will be comprised of four terms of academic work, the fourth year of two terms of academic work and two terms of student teaching.

Programs of Instruction

Students in the College of Education may choose a field of specialization in accordance with their particular interest and aptitudes. Specimen programs are shown on the pages which follow. While all but one are presented as co-operative programs, it is possible for full-time students to complete approximately the same programs in four years. These curricula are organized so that each student may acquire a comprehensive background in preparation for Elementary Education, Industrial Arts Education, and the following Secondary fields: English Education, Social Studies Education, Science Education and Mathematics Education.

Students preparing for elementary teaching should plan either to secure an academic major in Social Studies or English or two minors from the following: Art, English, Social Studies, Psychology, Sociology, Modern Languages and Physical Education. A minor in Modern Languages would require at least two years of high school preparation in that language.

Program for Industrial Arts Teaching

In collaboration with Wentworth Institute, Northeastern University is prepared to offer a unique program in the preparation of teachers in Industrial Arts education. A student interested in this program will attend Wentworth Institute for two years and, then, upon the presentation of proper credentials, can apply for admission to the College of Education at Northeastern. Once admitted, he will complete, at Northeastern, his preparation in General Education and Professional Education, either as a full-time or co-operative student.

National Teacher Examinations

All students who expect to make teaching their career will be expected to take the general and special National Teacher Examinations in their senior year.

Program in Elementary Education

FIRST YEAR†

TERM 1			TERM 2			TERM 3		
No.	Course	Cl. Cr.	No.	Course	Cl. Cr.	No.	Course	Cl. Cr.
30-01	English	3 3	30-02	English	3 3	30-03	English	3 3
23-01	West. Civ.	4 4	23-02	West. Civ.	4 4	23-03	West. Civ.	4 4
22-01	Am. Natl. Govt.	3 3	22-02	Am. Natl. Govt.	3 3	22-03	Am. Natl. Govt.	3 3
17-01	Surv. Sci.	3 3	17-02	Surv. Sci.	3 3	17-03	Surv. Sci.	3 3
21-60	Soc. Sci. I	3 3	21-61	Soc. Sci. II	3 3	21-62	Soc. Sci. III	3 3
16-10	Phys. Ed.	0 (2) 0	16-11	Phys. Ed.	0 (2) 0	16-12	Phys. Ed.	0 (2) 0
16 (2) 16			16 (2) 16			16 (2) 16		

SECOND YEAR

TERM 4*			TERM 5			TERM 6		
No.	Course	Cl. Cr.	No.	Course	Cl. Cr.	No.	Course	Cl. Cr.
30-04	English	5 2½	21-51	Human Dev. I	3 3	21-32	Reading in	— —
23-04	West. Civ.	4 2	29-01	Public Speaking	4 4	Elem. Schools	3 3	
17-04	Surv. Sci.	4 2	21-31	El. Lg. Art	3 3	21-35	Elem. Sch. Sci.	3 3
21-65	Psy. of Learn.	3 1½	21-33	Arith. for Tch.	3 3	21-52	Human Dev. II	3 3
16 — 8			23-11	Eur. Hist.	4 4	23-12	19th Cen. Eur.	4 4
			17 17			29-02	Public Speaking	4 4
						17 17		

THIRD YEAR

TERM 7*			TERM 8			TERM 9		
No.	Course	Cl. Cr.	No.	Course	Cl. Cr.	No.	Course	Cl. Cr.
Elective	8 4		21-53E	Learn. & Teach.	— —	21-54E	Learn. & Cur.	— —
Elective	8 4		Elem. Lab.	0 (2) 2	Elem. Lab.	0 (2) 2		
16 8			21-53	Learn. & Teach.	3 3	21-54	Learn. & the	3 3
			23-17	Amer. Hist.	4 4	Curriculum	3 3	
			to 1820	4 4	23-18	The U. S. 1820-	4 4	
			27-32	Creative Draw.	0 (6) 4	1890	4 4	
			30-35	Amer. Lit.	4 4	27-33	Theo. of Color	0 (6) 0
			to 1860	4 4	& Design I	0 (6) 0		
			11 (8) 17			30-36	Am. Lit. after	4 4
						1860	4 4	
						11 (8) 17		

FOURTH YEAR

TERM 10*			TERM 11			TERM 12		
No.	Course	Cl. Cr.	No.	Course	Cl. Cr.	No.	Course	Cl. Cr.
Elective	8 4		20-06	Prin. & Prob.	4 4	20-07	Prin. & Prob. of	4 4
Elective	8 4		of Econ.	4 4	Econ.	4 4		
16 8			21-37	Arts & Crafts in	3 3	21-39	Elem. Sch. Soc.	3 3
			Elem. School	3 3	Studies	3 3		
			21-55	Backgrounds of	3 3	21-56	Backgrounds of	3 3
			Amer. Ed. I	3 3	Amer. Ed. II	3 3		
			30-33	Survey of Eng.	4 4	30-34	Survey of Eng.	4 4
			Lit.	4 4	Lit.	4 4		
			Elective	4 4	Elective	4 4		
			18 18			18 18		

FIFTH YEAR

TERM 14			TERM 15		
No.	Course	Cl. Cr.	No.	Course	Cl. Cr.
21-38	Elem. Sch. Mus.	3 3	21-50	Spec. Education	1½ 4
Elective	4 4		Elective	4 4	
Elective	4 4		Elective	4 4	
Elective	4 4		Elective	4 4	
15 15			13½ 13½		

TERMS 14A AND 15A (2 Terms)†

21-40 Student Teaching and
Related Seminar 14 Credits

*Summer term — 5 weeks. () indicate laboratory hours.

†All physically qualified male freshmen may elect ROTC if they so desire. Students accepted for the ROTC will not be required to take Physical Training in Terms 1, 2, 3, and will be permitted to substitute advanced ROTC courses for certain upperclass academic work as approved by the Dean up to a maximum of 6 credits.

‡21-40 Student Teaching (14 credits) is required during both Co-operative Work periods of the senior year

Program in Teaching of English and Social Studies

FIRST YEAR†

TERM 1			TERM 2			TERM 3		
No.	Course	Cl. Cr.	No.	Course	Cl. Cr.	No.	Course	Cl. Cr.
0-01	English	3 3	30-02	English	3 3	30-03	English	3 3
3-01	West. Civ.	4 4	23-02	West. Civ.	4 4	23-03	West. Civ.	4 4
2-01	Am. Natl. Govt.	3 3	22-02	Am. Natl. Govt.	3 3	22-03	Am. Natl. Govt.	3 3
7-01	Surv. Sci.	3 3	17-02	Surv. Sci.	3 3	17-03	Surv. Sci.	3 3
1-60	Soc. Sci. I	3 3	21-61	Soc. Sci. II	3 3	21-62	Soc. Sci. III	3 3
6-10	Phys. Ed.	0 (2) 0	16-11	Phys. Ed.	0 (2) 0	16-12	Phys. Ed.	0 (2) 0
		16 (2) 16			16 (2) 16			16 (2) 16

SECOND YEAR

TERM 4*			TERM 5			TERM 6		
No.	Course	Cl. Cr.	No.	Course	Cl. Cr.	No.	Course	Cl. Cr.
0-04	English	5 2½	21-51	Human Dev. I	3 3	21-52	Human Dev. II	3 3
3-04	West. Civ.	4 2	29-01	Public Speaking	4 4	29-02	Public Speaking	4 4
7-04	Surv. Sci.	4 2	23-11	18th Cent. Eng.	4 4	23-12	19th Cent. Eng.	4 4
1-65	Psy. of Learn.	3 1½	24-01	Intr. Phil.	4 4	24-02	Prob. Phil.	4 4
		16 — 8	30-33	Eng. Lit.	4 4	30-34	Eng. Lit.	4 4
					19 — 19			19 — 19

THIRD YEAR

TERM 7*			TERM 8			TERM 9		
No.	Course	Cl. Cr.	No.	Course	Cl. Cr.	No.	Course	Cl. Cr.
Elective	8 4		21-53S	Learn. & Teach. Sec. Lab.	0 (2) 2	21-54S	Learn. & Cur. Sec. Lab.	0 (2) 2
Elective	8 4		21-53	Learn. & Teach.	3 3	21-54	Learn. & the Curriculum	3 3
	16 8		23-17	Amer. Hist. to 1820	4 4	23-18	The U. S. 1820-1890	4 4
			27-32	Creative Draw.	0 (6) 4	27-33	Theo. of Color & Design II	0 (6) 4
			30-35	Amer. Lit. to 1860	4 4	30-36	Amer. Lit. after 1860	4 4
					11 (8) 17			11 (8) 17

FOURTH YEAR

TERM 10*			TERM 11			TERM 12		
No.	Course	Cl. Cr.	No.	Course	Cl. Cr.	No.	Course	Cl. Cr.
Elective	8 4		20-06	Prins. & Probs. of Econ.	4 4	20-07	Prins. & Probs. of Econ.	4 4
Elective	8 4		Elective	4 4		21-50	Spec. Education	1½ 2
	16 8		21-55	Backgrounds of Amer. Ed. I	3 3	21-56	Backgrounds of Amer. Ed. II	3 3
			22-11	Foreign Govts. or	4 4	22-12	Foreign Govts. or	4 4
			30-27	Master of the Drama	4 4	30-28	Master of the Drama	4 4
			History Elective	4 4		History Elective	4 4	
			or			or		
			English Elective	4 4		English Elective	4 4	
					19 — 19			16½ 17

FIFTH YEAR

TERM 14			TERM 15		
No.	Course	Cl. Cr.	No.	Course	Cl. Cr.
22-13	Political Theory	4 4	22-14	Political Theory	4 4
or			or		
30-21	Intermediate Writing	4 4	30-22	Intermediate Writing	4 4
30-51	Intro. to Journalism	4 4	30-52	Intro. to Journalism	4 4
or			or		
History Elective	4 4		History Elective	4 4	
Elective	4 4		Elective	4 4	
Elective	4 4		Elective	4 4	
		16 16			16 16

TERMS 14A AND 15A (2 Terms)†

21-40 Student Teaching and Related Seminar 14 Credits

Program in Teaching of Science and Mathematics

FIRST YEAR†

TERM 1			TERM 2			TERM 3		
No.	Course	Cl. Cr.	No.	Course	Cl. Cr.	No.	Course	Cl. Cr.
30-01	English	3 3	30-02	English	3 3	30-03	English	3 3
11-01	Gen. Chem.	3 (3) 4	11-02	Gen. Chem.	3 (3) 4	11-03	Gen. Chem.	3 (3) 4
14-61	Math. I	5 4	14-62	Math. II	5 4	14-63	Math III.	5 4
15-51	Physics	3 3	15-52	Physics	3 3	15-53	Physics	3 3
16-10	Phys. Ed.	0 (2) 0	16-11	Phys. Ed.	0 (2) 0	16-12	Phys. Ed.	0 (2) 0
21-60	Soc. Sci. I	3 3	21-61	Soc. Sci. II	3 3	21-62	Soc. Sci. III	3 3
17 (5) 17			17 (5) 17			17 (5) 17		

SECOND YEAR

TERM 4*			TERM 5			TERM 6		
No.	Course	Cl. Cr.	No.	Course	Cl. Cr.	No.	Course	Cl. Cr.
1-014	Gen. Chem.	3 (3) 2	21-51	Human Dev. I	3 3	21-52	Human Dev. II	3 3
14-64	Math. IV	5 2½	29-01	Public Speaking	4 4	29-02	Public Speaking	4 4
15-54	Physics	5 2½	14-05	Diff. Calc.	4 4	14-06	Int. Calc.	4 4
21-65	Psy. of Learn.	3 1½	15-05	Physics	4 (3) 5	15-06	Physics	3 (3) 4
16 (3) 8½			15 (3) 16			14 (3) 17		

THIRD YEAR

TERM 7*			TERM 8			TERM 9		
No.	Course	Cl. Cr.	No.	Course	Cl. Cr.	No.	Course	Cl. Cr.
Elective	8 4		14-07	Diff. Equa.	4 4	14-08	Diff. Equa. II	4 4
Elective	8 4		21-53	Learn. & Teach.	3 3	21-54	Learn. & the Curriculum	3 3
16 8			21-53S	Learn. & Teach. Sec. Lab.	0 (2) 2	21-54S	Learn. & Cur. Sec. Lab.	0 (2) 2
			27-32	Creative Draw. Sci. Elective	0 (6) 4 4 4	27-33	Theo. of Color & Design I Sci. Elective	0 (6) 4
			11 (8) 17			11 (8) 17		

FOURTH YEAR

TERM 10*			TERM 11			TERM 12		
No.	Course	Cl. Cr.	No.	Course	Cl. Cr.	No.	Course	Cl. Cr.
Elective	8 4		21-55	Backgrounds of Amer. Ed. I	3 3	21-50	Spec. Education	1½ 4
Elective	8 4		30-35	Amer. Lit. to 1860	4 4	21-56	Backgrounds of Amer. Ed. II	3 4
16 8				Sci. Elective	4 4	30-36	Amer. Lit. after 1860	4 4
			14-15	Ad. Calculus	4 4		Sci. Elective	4 4
				Elective	4 4	14-16	Ad. Calculus	4 4
			19 19			16½ 16½		

FIFTH YEAR

TERM 14			TERM 15		
Science	4	4	Science	4	
Mathematics	4	4	Mathematics	4	
Elective	4	4	Elective	4	
Elective	4	4	Elective	4	
		— —			— —
		16 16			16
TERMS 14A AND 15A (2 Terms)†					
21-40 Student Teaching and Related Seminar 14 Credits					

*Summer term — 5 weeks. () indicate laboratory hours.

†All physically qualified male freshmen may elect ROTC if they so desire. Students accepted for the ROTC will not be required to take Physical Training in Terms 1, 2, 3, and will be permitted to substitute advanced ROTC courses for certain upperclass academic work as approved by the Dean up to a maximum of 6 credits.

‡21-40 Student Teaching (14 credits) is required during both Co-operative Work periods of the senior year.

Program in Teaching of Industrial Arts

FIRST TWO YEARS — At Wentworth Institute

Depending upon which program a student follows at Wentworth, he may transfer to Northeastern University College of Education with either 40 semester hours (64 credit hours) or 60 semester hours (96 credit hours).

Plan I. The program below indicates the way a person may pursue his program at Northeastern by transferring 64 credit hours. He may attend one full-time year of 30 weeks and two co-operative years of 25 weeks each. In all he will need 80 weeks of academic work plus 20 weeks of student teaching.

Plan II. Transferring with 96 credit hours, a student may take three years on the Co-operative Plan (without summer terms) or two years on the full-time plan. In any case, he will need 60 weeks of academic work and 20 weeks of student teaching.

THIRD YEAR — At Northeastern

TERM 8			TERM 8A			TERM 9		
No.	Course	Cl.	No.	Course	Cl.	No.	Course	Cl.
1-51	Human Dev.	3		Elective	3	21-52	Human Dev. II	3
3-11	18th Cen. Eur.	4		Elective	4	23-12	19th Cen. Eur.	4
6-01	Prins. of Sociol.	4		Elective	4	26-02	Prins. of Sociol.	4
9-01	Public Speaking	4		Elective	4	29-02	Public Speaking	4
0-06	Prins. & Probs. of Econ.	4		Elective	3	20-07	Prins. & Probs. of Econ.	4
		— — —			18			19
		19			18			19

FOURTH YEAR

TERM 10*			TERM 11			TERM 12		
	Elective	8	21-53	Learn. & Teach	3	21-54	Learn. & the Curriculum	3
	Elective	8	21-53S	Learn. & Teach. Sec. Lab.	0 (2)	21-54S	Learn. & Cur. Sec. Lab.	0 (2)
		16	23-17	Amer. Hist. to 1820	4	23-18	The U. S. 1820-1890	4
			27-32	Creative Draw.	0 (6)	27-33	Theo. of Color & Design I	0 (6)
			30-35	Amer. Lit. to 1860	4	30-36	Amer. Lit. after 1860	4
					11 (8)			11 (8)

FIFTH YEAR

TERM 13*			TERM 14			TERM 15		
	Elective	8	30-33	Survey of Eng. Lit.	4	30-34	Survey of Eng. Lit.	4
	Elective	8	21-55	Backgrounds of Amer. Ed. I	3	21-50	Spec. Education	1½
		16		Elective	4	21-56	Backgrounds of Amer. Ed. II	3
				Elective	4		Elective	4
				Elective	3		Elective	3
					18			15½

TERMS 14A AND 15A (2 Terms)†

21-40 Student Teaching and Related Seminar 14 Credits

Summer Term — 5 weeks. () indicate laboratory hours.

1-40 Student Teaching (14 credits) is required during both Co-operative Work periods of the senior year.

THE COLLEGE OF BUSINESS ADMINISTRATION

Policy

The College of Business Administration offers programs of study to meet the needs of young men and women who hope to fill administrative positions. Business education shares with higher education generally the responsibility to illuminate for the student the society in which he lives, the culture to which he is heir and trustee, and the challenges which the world poses for himself and his country. Business education shares with professional education generally the obligation to impart the nature of the professional obligation, the role of the professional in society, and the fundamental skills whose proper use justify the title of "professional." The core curriculum of a College of Business must meet both these sets of criteria with the highest possible standards.

The first criterion implies that courses in the Liberal Arts — English literature and writing, history, the social sciences — are not accidental adjuncts to the professional courses, but are an integral and essential component of the curriculum. The second criterion implies that professional courses must deal with fundamental skills, and must relate these to the broader context of the role and responsibility of the business firm, rather than impart specific vocational techniques. Such techniques have a legitimate place in the curriculum, but are not of its essence; rather, they are proper subjects for special study after the more central elements have been satisfied.

The academic content of the different curricula in the College of Business Administration is divided roughly as follows: one half in Liberal Arts, one-third in the social sciences, one-quarter in a special branch of business, and one-quarter in related business subjects. Since periods of probation and apprenticeship are inherent in the nature of positions at the administrative level, the Northeastern programs based upon the Co-operative Plan are especially significant.

Aims

In keeping with current trends in collegiate business education, the educational policy of the College is directed toward the achievement of the following purposes:

First: To offer a college program which will help students select the field of business best suited to their aptitudes. The Co-operative Plan is particularly effective in this respect.

Second: To build breadth of perspective and provide sufficient specialization to meet basic professional requirements.

Third: To provide a thorough knowledge of fundamental economic laws and an understanding of their applications in business.

Fourth: To develop the habits of accurate thinking that are essential to sound judgment.

Fifth: To develop attitudes and ideals that are ethically sound and socially desirable.

Methods

In order that these aims may be realized as fully as possible, the College makes use of the problem and the case methods of instruction in addition to the lecture and recitation system. Students should learn to analyze every proposition, to challenge unsupported assertions, to think independently, and to support their thinking with logic and facts.

Hence, concrete problems and cases which executives have faced in accounting, marketing, organizing, and the like constitute a large proportion of class-work in the upper years.

Admission Requirements

Applicants for admission to the freshman class must qualify by graduation from an approved course of study in an accredited secondary school, including prescribed subjects listed on page 30.

Requirements for Graduation

Students may qualify for the degree of Bachelor of Science in Business Administration in one of the following options: Accounting, Business Management, Finance and Insurance, Industrial Relations, and Marketing and Advertising.

Candidates for the Bachelor of Science degree must complete all of the prescribed work of the curriculum in which they seek to qualify with a degree of proficiency acceptable to the faculty. Students who undertake co-operative work assignments must also meet the requirements of the Department of Co-operative Work before they become eligible for their degrees.

Students transferring from another college or university are not eligible to receive the B.S. degree until they have completed at least one academic year at Northeastern immediately preceding their graduation.

Scholarship Requirements

The degree conferred not only represents the formal completion of the subjects in the selected course of study but also indicates professional competence in the designated field of specialization. Those who are clearly unable to meet the accepted standard of attainment will be required to withdraw from the University.

Graduation with Honor

Candidates who have achieved distinctly superior attainment in their academic work will be graduated with honor. Upon special vote of the faculty a limited number of this group may be graduated with high honor or with highest honor. Students must have been in attendance at the University at least three years before they may become eligible for honors at graduation.

Thesis Option

Theses are not required of candidates for the degree of Bachelor of Science in Business Administration. Students who show special aptitude for thesis work, however, may be permitted to substitute an appropriate thesis for equivalent work in class. Such permission must be obtained by the candidate from the Dean of the College.

The Programs of Study

First Year

A full year of thirty weeks is devoted to a survey of the economic, political, and social institutions that underlie the conduct of business.

The basic tool of business, the keeping of accounts, is introduced during the first year to provide a practical check upon the interest and capacity of each student in the College of Business Administration.

English is given an important place and other courses fill the personal needs of the student and prepare him for the more advanced work. Throughout the year each student has the friendly counsel and guidance of a faculty adviser whose aim is to help bridge the gap between high school and college.

Upperclass Years

Under the Northeastern five-year Co-operative Plan, training on the job starts with the second year. At the end of the second year, at the close of Term 6, students formally elect their curricular options in accordance with their major fields of interest and natural aptitudes. During Term 14 all students take a one credit course, Techniques of Placement, in order to study the generally accepted theories and methods of job placement. Each student is then encouraged under expert guidance in Term 15 to apply the findings to himself and make use of them in connection with his own after graduation placement.

The Professional Options

All students are required to take common courses which are deemed necessary for a basic understanding of business and business administration. These courses are pursued jointly with professional work which has been selected with a view to meeting the changing and expanding needs of present day business conduct. Students are required to select a professional option before the end of their sophomore year. The purpose of the professional option is to satisfy the different interests of students while enrolled in the College of Business Administration and to prepare the student for his entry into the business community. A brief statement of the nature of vocational opportunities in the various professional fields is presented below but the reader should observe one note of caution. Employment after graduation and success in the business world are seldom determined solely by the student's professional option. These are more the result of personal qualities which must be developed regardless of professional option.

I. Accounting — Many successful careers are open to professional accountants. Their services are demanded by business, commerce, industry, and government. Better known among the wide variety of titles descriptive of their work are public and private accountant, controller, cost accountant, resident and traveling auditor, credit manager, statistician, investigator, adjuster, and financial accountant.

II. Business Management — This option appeals to the student who is interested in a broad education in business administration. Graduates in Business Management find positions in commercial, manufacturing, and service business. These positions cut across the whole span of business activity depending upon the student's interest and ability. Production planning and control, industrial purchasing and sales, cost control, methods analysis, time study, industrial safety, management training, self-employment, and many other vocational opportunities are available to graduates of this program.

III. Finance and Insurance — Financial institutions serving present-day business and industry are its life stream. Any list of these organizations which are indispensable in the conduct of business must include banks, insurance companies, investment houses, credit concerns, financial exchanges, business forecasting organizations, financial service institutions, mortgage companies, national and local real estate brokerage firms, and appraisers.

The option in Finance and Insurance opens the door to a host of careers in these institutions as well as the many governmental agencies regulating their operations.

IV. Industrial Relations — The day is past when "anyone" can direct labor-management relations. A host of opportunities exist, therefore, in this field, the human side of conducting a business. Both unions and management offer a wide selection of positions in personnel, bargaining, wage administration, and public relations. The government, too, has many openings for men and women who have taken this program of studies.

V. Marketing and Advertising — The high levels of living of which our nation is proud are today recognized to be the result of a business and social climate in which business executives have traditionally taken the initiative in improving products and in bettering the terms on which goods are offered to consumers. Today more than ever in our economy the seller, rather than the buyer or consumer, takes the initiative. Selling leadership and sales initiative thus put into motion the series of events that result in a purchase by the consumer.

In this process marketing management plays a key role. Its function is to create the sales that are the lifeblood of business progress. Without the highly developed techniques of modern merchandising, advertising, and sales leadership, plus skills in overall marketing direction, our present vast national production would stumble and stagnate.

With proper training in the fertile fields of marketing administration and sales stimulation, the student gifted with imagination and ambition sees before him a vital and rewarding future.

Commercial Education and Secretarial Studies

It is possible for qualified students in any of the above curricula to elect in Terms 7, 10, 13, 14, and 15 certain courses in education as part qualification for a secondary school teaching certificate in business subjects and social studies.

Women students will be given the opportunity to take a sequence of courses in secretarial studies as part qualification for executive secretarial positions or to teach in this field.

Curriculum in Accounting

FIRST YEAR†

TERM 1			TERM 2			TERM 3		
No.	Course	Cl. Cr.	No.	Course	Cl. Cr.	No.	Course	Cl. Cr.
30-01	English	3 3	30-02	English	3 3	30-03	English	3 3
20-01	Econ. Geog.	3 3	20-02	Econ. Geog.	3 3	20-04	Int. to Econ.	3 3
22-01	Am. Natl. Govt.	3 3	22-02	Am. Natl. Govt.	3 3	22-03	Am. Natl. Govt.	3 3
41-01	Prin. of Acct.	4 4	41-02	Prin. of Acct.	4 4	41-03	Prin. of Acct.	4 4
27-11	Hist. Civil.	4 4	27-12	Hist. Civil.	4 4	27-13	Hist. Civil.	4 4
16-10	Phys. Ed.	0 (2) 0	16-11	Phys. Ed.	0 (2) 0	16-12	Phys. Ed.	0 (2) 0
17 (2) 17			17 (2) 17			17 (2) 17		

SECOND YEAR

TERM 4*			TERM 5			TERM 6		
No.	Course	Cl. Cr.	No.	Course	Cl. Cr.	No.	Course	Cl. Cr.
30-04	English Lit.	5 2½	43-21	Prin. of Mktg.	3 3	43-22	Prin. of Adv.	3 3
20-09	Int. to Stat.	3 (6) 3	44-20	Int. to Fin.	3 3	44-22	Prin. of Ins.	3 3
	(Graphic Pres.)		45-21	Prin. of Bus.		45-22	Prin. of Bus.	
	or			Mgt.	3 3		Mgt.	3 3
47-09	Typing	3 (6) 3	41-27	Acctg. State.	4 4	41-26	Inter. Acct.	4 4
27-14	Hist. Civil.	4 2	25-01	Intro. to Psych.	4 4	25-02	Gen. Psych.	4 4
12 (6) 7½			17 17			17		

THIRD YEAR

TERM 7*			TERM 8			TERM 9		
No.	Course	Cl. Cr.	No.	Course	Cl. Cr.	No.	Course	Cl. Cr.
20-13	Econ. Prin.	8 4	20-14	Econ. Probs.	4 4	20-15	Econ. Probs.	4 4
26-07	Soc. Probs.	8 4	29-01	Public Speaking	4 4	29-02	Public Speaking	4 4
	or		44-31	Bus. Finance	4 4	44-32	Bus. Finance	4 4
14-41	Fund. of Math.	8 4	41-37	Int. Acct.	2 (2) 3	41-38	Int. Acct.	2 (2) 3
			41-31	Cost Acct.	2 (2) 3	41-32	Cost Acct.	2 (2) 3
16 8			16 (4) 18			16 (4) 16 (4)		

FOURTH YEAR

TERM 10*			TERM 11			TERM 12		
No.	Course	Cl. Cr.	No.	Course	Cl. Cr.	No.	Course	Cl. Cr.
24-40	El. of Phil.	5 2½	20-18	Am. Ec. Hist.	4 4	20-21	Statistics	3 (2) 3
	Elective	5 2½	20-20	Statistics	3 (2) 4	46-42	Leg. Asp. of	
	Elective	5 2½	46-41	Leg. Asp. of			Bus. II	4 4
				Bus. I	4 4	30-17	Lit.	3 3
			41-48	Cost Acct.	3 3	41-47	Consol. State.	3 3
			41-45	Adv. Acct.	3 3	41-55	Adv. Acct.	3 3
15 7½			17 (2) 18			16 (2) 16 (2)		

FIFTH YEAR

TERM 13*			TERM 14			TERM 15		
No.	Course	Cl. Cr.	No.	Course	Cl. Cr.	No.	Course	Cl. Cr.
24-41	Probs. of Phil.	5 2½	20-40	Bus. & Govt.	4 4	20-28	Comp. Ec. Sy.	4 4
	Elective	5 2½	46-57	Law of Corp.			or	
	Elective	5 2½		Fin. & Ins.	4 4	20-65	Res. Meth.	4 4
			46-53	Basic Fed.		46-54	Basic Fed.	
				Taxes	2 (2) 3		Taxes	2 (2) 3
			41-43	Auditing	3 3	41-44	Audit.	3 3
			41-61	Sem. in Ac.	3 3	41-62	Sem. in Acctg.	2 4
			50-10	Placement		30-48	Mod. Drama	4 4
				Techniques	2 1			
15 7½			18 (2) 18			14 (2) 14 (2)		

*Summer term — 5 weeks. () indicate laboratory hours.

†All physically qualified male freshmen may elect ROTC if they so desire. Students accepted for the ROTC will not be required to take Physical Training in Terms 1, 2, 3, and will be permitted to substitute advanced ROTC courses for certain upperclass academic work as approved by the Dean up to a maximum of 6 credits.

Curriculum in Business Management

FIRST YEAR†

TERM 1			TERM 2			TERM 3		
No.	Course	Cl. Cr.	No.	Course	Cl. Cr.	No.	Course	Cl. Cr.
0-01	English	3 3	30-02	English	3 3	30-03	English	3 3
0-01	Econ. Geog.	3 3	20-02	Econ. Geog.	3 3	20-04	Int. to Econ.	3 3
2-01	Am. Natl. Govt.	3 3	22-02	Am. Natl. Govt.	3 3	22-03	Am. Natl. Govt.	3 3
1-01	Prin. of Acct.	4 4	41-02	Prin. of Acct.	4 4	41-03	Prin. of Acct.	4 4
7-11	Hist. Civil.	4 4	27-12	Hist. Civil.	4 4	27-13	Hist. Civil.	4 4
6-10	Phys. Ed.	0 (2) 0	16-11	Phys. Ed.	0 (2) 0	16-12	Phys. Ed.	0 (2) 0
17 (2) 17			17 (2) 17			17 (2) 17		

SECOND YEAR

TERM 4*			TERM 5			TERM 6		
No.	Course	Cl. Cr.	No.	Course	Cl. Cr.	No.	Course	Cl. Cr.
0-04	English Lit.	5 2½	43-21	Prin. of Mktg.	3 3	43-22	Prin. of Adv.	3 3
0-09	Int. to Stat. (Graphic Pres.) or	3 (6) 3	44-20	Int. to Fin.	3 3	44-22	Prin. of Ins.	3 3
7-09	Typing	3 (6) 3	45-21	Prin. of Bus. Mgt.	3 3	45-22	Prin. of Bus. Mgt.	3 3
7-14	Hist. Civil.	4 2	41-27	Acctg. State.	4 4	41-28	Int. to Cost Acctg.	4 4
12 (6) 7½			25-01	Intro. to Psych.	4 4	25-02	Gen. Psych.	4 4
			17 17			17 17		

THIRD YEAR

TERM 7*			TERM 8			TERM 9		
No.	Course	Cl. Cr.	No.	Course	Cl. Cr.	No.	Course	Cl. Cr.
0-13	Econ. Prin.	8 4	20-14	Econ. Probs.	4 4	20-15	Econ. Probs.	4 4
6-07	Soc. Probs. or	8 4	44-31	Bus. Finance	4 4	44-32	Bus. Finance	4 4
4-41	Fund. of Math.	8 4	29-01	Public Speaking	4 4	29-02	Public Speaking	4 4
16 8			25-35	Ind. Psych.	3 3	25-36	Ind. Psych.	3 3
			45-35	Prod. Mgt.	3 3	45-36	Pers. Mgt.	3 3
			18 18			18 18		

FOURTH YEAR

TERM 10*			TERM 11			TERM 12			
1-33	Cost for Mgt.	10 5	20-20	Statistics	3 (2) 4	20-21	Statistics	3 (2) 4	
	Elective	5 2½	20-18	Am. Ec. Hist.	4 4	23-06	Rec. Eur. Hist.	3 3	
			46-41	Leg. Asp. of Bus. I	4 4	46-42	Leg. Asp. of Bus. II	4 4	
				24-40	El. of Phil.	3 3	24-41	Probs. of Phil.	3 3
			45-37	Pers. Mgt.	3 3	20-26	Labor Ec.	3 3	
		15 7½			17 (2) 18			16 (2) 17	

FIFTH YEAR

TERM 13*			TERM 14			TERM 15		
1-42 Budget Proc.	5	2½	20-40 Bus. & Govt.	4	4	20-28 Comp. Ec. Sy. or	4	4
Elective	5	2½	43-43 Mktg. Res.	4	4	20-65 Res. Meth.	4	4
Elective	5	2½	45-52 Mgt. of Sales	2	2	46-56 Law of Merch.	4	4
			45-61 Sem. in Policy and Org.	3	3	30-48 Mod. Drama	4	4
			30-47 Mod. Novel	4	4	45-62 Sem. in Mgt.	4	4
			50-10 Place. Tech.	2	1			
	15	7½		19	18		16	16

Summer term — 5 weeks. () indicate laboratory hours.

All physically qualified male freshmen may elect ROTC if they so desire. Students accepted for the ROTC will not be required to take Physical Training in Terms 1, 2, 3, and will be permitted to substitute advanced ROTC courses for certain upperclass academic work as approved by the Dean up to a maximum of 12 credits.

Curriculum in Finance and Insurance

FIRST YEAR†

TERM 1			TERM 2			TERM 3		
No.	Course	Cl. Cr.	No.	Course	Cl. Cr.	No.	Course	Cl. Cr.
30-01	English	3 3	30-02	English	3 3	30-03	English	3 3
20-01	Econ. Geog.	3 3	20-02	Econ. Geog.	3 3	20-04	Int. to Econ.	3 3
22-01	Am. Natl. Govt.	3 3	22-02	Am. Natl. Govt.	3 3	22-03	Am. Natl. Govt.	3 3
41-01	Prin. of Acct.	4 4	41-02	Prin. of Acct.	4 4	41-03	Prin. of Acct.	4 4
27-11	Hist. Civil.	4 4	27-12	Hist. Civil.	4 4	27-13	Hist. Civil.	4 4
16-10	Phys. Ed.	0 (2) 0	16-11	Phys. Ed.	0 (2) 0	16-12	Phys. Ed.	0 (2) 0
<hr/> 17 (2) 17			<hr/> 17 (2) 17			<hr/> 17 (2) 17		

SECOND YEAR

TERM 4*			TERM 5			TERM 6		
No.	Course	Cl. Cr.	No.	Course	Cl. Cr.	No.	Course	Cl. Cr.
30-04	English Lit.	5 2½	43-21	Prin. of Mktg.	3 3	43-22	Prin. of Adv.	3 3
20-09	Int. to Stat. (Graphic Pres.)	3 (6) 3	44-20	Int. to Fin.	3 3	44-22	Prin. of Ins.	3 3
or			45-21	Prin. of Bus. Mgt.	3 3	45-22	Prin. of Bus. Mgt.	3 3
47-09	Typing	3 (6) 3	41-27	Acctg. State.	4 4	41-28	Int. to Cost Acctg.	4 4
27-14	Hist. Civil.	4 2	25-01	Int. to Psych.	4 4	25-02	Gen. Psych.	4 4
<hr/> 12 (6) 7½			<hr/> 17 17			<hr/> 17 17		

THIRD YEAR

TERM 7*			TERM 8			TERM 9		
No.	Course	Cl. Cr.	No.	Course	Cl. Cr.	No.	Course	Cl. Cr.
20-13	Prin. of Econ.	8 4	20-14	Econ. Probs.	4 4	20-15	Econ. Probs.	4 4
26-07	Soc. Probs.	8 4	44-31	Bus. Finance	4 4	44-32	Bus. Finance	4 4
or			44-33	Life Ins.	3 3	44-34	Prop. Ins.	3 3
14-41	Fund. of Math.	8 4	29-01	Public Speaking	4 4	29-02	Public Speaking	4 4
			44-35	Estate Plan. and Tax.	3 3	44-36	Estate Plan. and Tax.	3 3
<hr/> 16 8			<hr/> 18 18			<hr/> 18 18		

FOURTH YEAR

TERM 10*			TERM 11			TERM 12		
No.	Course	Cl. Cr.	No.	Course	Cl. Cr.	No.	Course	Cl. Cr.
24-40	El. of Phil.	5 2½	20-20	Statistics	3 (2) 4	20-21	Statistics	3 (2) 4
Elective	5 2½		20-18	Am. Ec. Hist.	4 4	20-51a	Pub. Fin.	3 3
Elective	5 2½		46-41	Leg. Asp. of Bus. I	4 4	46-42	Leg. Asp. of Bus. II	4 4
			44-41	Invest. I	3 3	44-42	Invest. II	3 3
			20-24a	Mon. & Bkg.	3 3	30-17	Literature	3 3
<hr/> 15 7½			<hr/> 17 (2) 18			<hr/> 16 (2) 16		

FIFTH YEAR

TERM 13*			TERM 14			TERM 15		
No.	Course	Cl. Cr.	No.	Course	Cl. Cr.	No.	Course	Cl. Cr.
24-41	Probs. of Phil.	5 2½	20-40	Bus. & Govt.	4 4	20-28	Comp. Ec. Sy.	4 4
Elective	5 2½		46-57	Law of Corp. Fin. & Ins.	4 4	or		
Elective	5 2½		44-52	Sec. Mkts.	3 3	20-65	Res. Meth.	4 4
			44-61	Sem. in Fin. and Ins.	3 3	44-62	Seminar in Fin. and Ins.	4 4
			23-06	Rec. Eur. Hist.	3 3	20-25	Bus. Cycles	4 4
			50-10	Place. Tech.	2 1	30-48	Mod. Drama	4 4
<hr/> 15 7½			<hr/> 19 18			<hr/> 16 16		

*Summer term — 5 weeks. () indicate laboratory hours.

†All physically qualified male freshmen may elect ROTC if they so desire. Students accepted for the ROTC will not be required to take Physical Training in Terms 1, 2, 3, and will be permitted to substitute advanced ROTC courses for certain upperclass academic work as approved by the Dean up to a maximum of credits.

Curriculum in Industrial Relations

FIRST YEAR†

TERM 1			TERM 2			TERM 3		
No.	Course	Cl. Cr.	No.	Course	Cl. Cr.	No.	Course	Cl. Cr.
01	English	3 3	30-02	English	3 3	30-03	English	3 3
01	Econ. Geog.	3 3	20-02	Econ. Geog.	3 3	20-04	Int. to Econ.	3 3
01	Am. Natl. Govt.	3 3	22-02	Am. Natl. Govt.	3 3	22-03	Am. Natl. Govt.	3 3
01	Prin. of Acct.	4 4	41-02	Prin. of Acct.	4 4	41-03	Prin. of Acct.	4 4
11	Hist. Civil.	4 4	27-12	Hist. Civil.	4 4	27-13	Hist. Civil.	4 4
10	Phys. Ed.	0 (2) 0	16-11	Phys. Ed.	0 (2) 0	16-12	Phys. Ed.	0 (2) 0
		17 (2) 17			17 (2) 17			17 (2) 17

SECOND YEAR

TERM 4*			TERM 5			TERM 6		
04	English Lit.	5 2½	43-21	Prin. of Mktg.	3 3	43-22	Prin. of Adv.	3 3
09	Int. to Stat. (Graphic Pres.) or	3 (6) 3	44-20	Int. to Fin.	3 3	44-22	Prin. of Ins.	3 3
09	Typing	3 (6) 3	45-21	Prin. of Bus. Mgt.	3 3	45-22	Prin. of Bus. Mgt.	3 3
14	Hist. Civil.	4 2	41-27	Acctg. State.	4 4	41-28	Int. to Cost Acctg.	4 4
		12 (6) 7½	25-01	Intro. to Psych.	4 4	25-02	Gen. Psych.	4 4
					17 17			17 17

THIRD YEAR

TERM 7*			TERM 8			TERM 9		
13	Econ. Prin.	8 4	20-14	Econ. Prob.	4 4	20-15	Econ. Prob.	4 4
07	Soc. Probs. or	8 4	44-31	Bus. Finance	4 4	44-32	Bus. Finance	4 4
41	Fund. of Math.	8 4	29-01	Public Speaking	4 4	29-02	Public Speaking	4 4
		16 8	45-35	Prod. Mgt.	3 3	45-36	Pers. Mgt.	3 3
			25-35	Ind. Psych.	3 3	25-36	Ind. Psych.	3 3
					18 18			18 18

FOURTH YEAR

TERM 10*			TERM 11			TERM 12		
33	Cost for Mgt.	10 5	20-20	Statistics	3 (2) 4	20-21	Statistics	3 (2) 4
	Elective	5 2½	20-18	Am. Ec. Hist.	4 4	20-26	Labor Ec.	3 3
			46-41	Leg. Asp. of Bus. I	4 4	46-42	Leg. Asp. of Bus. II	4 4
			45-37	Pers. Mgt.	3 3	23-06	Rec. Eur. Hist.	3 3
			24-40	El. of Phil.	3 3	24-41	Probs. of Phil.	3 3
		15 7½			17 (2) 18			16 (2) 17

FIFTH YEAR

TERM 13*			TERM 14			TERM 15		
42	Bud. Proc.	5 2½	20-40	Bus. & Govt.	4 4	20-28	Comp. Ec. Sys.	4 4
	Elective	5 2½	46-55	Labor Law	3 3		or	
	Elective	5 2½	42-52	Mot. & Time	2 (2) 3	20-65	Res. Meth.	4 4
			45-61	Sem. in Policy and Org.	3 3	26-17	Urban Soc.	4 4
			30-47	Mod. Novel	4 4	42-62	Sem. Col. Bg.	4 4
			50-10	Place. Tech.	2 1	20-25	Bus. Cycles	4 4
		15 7½			18 (2) 18			16 16

† Summer term — 5 weeks. () indicate laboratory hours.

† All physically qualified male freshmen may elect ROTC if they so desire. Students accepted for the ROTC will not be required to take Physical Training in Terms 1, 2, 3, and will be permitted to substitute advanced ROTC courses for certain upperclass academic work as approved by the Dean up to a maximum of 12 credits.

Curriculum in Marketing and Advertising

FIRST YEAR†

TERM 1			TERM 2			TERM 3		
No.	Course	Cl. Cr.	No.	Course	Cl. Cr.	No.	Course	Cl. Cr.
30-01	English	3 3	30-02	English	3 3	30-03	English	3
20-01	Econ. Geog.	3 3	20-02	Econ. Geog.	3 3	20-04	Int. to Econ.	3
22-01	Am. Natl. Govt.	3 3	22-02	Am. Natl. Govt.	3 3	22-03	Am. Natl. Govt.	3
41-01	Prin. of Acct.	4 4	41-02	Prin. of Acct.	4 4	41-03	Prin. of Acct.	4
27-11	Hist. Civil.	4 4	27-12	Hist. Civil.	4 4	27-13	Hist. Civil.	4
16-10	Phys. Ed.	0 (2) 0	16-11	Phys. Ed.	0 (2) 0	16-12	Phys. Ed.	0 (2)
		17 (2) 17			17 (2) 17			17 (2)

SECOND YEAR

TERM 4*			TERM 5			TERM 6		
No.	Course	Cl. Cr.	No.	Course	Cl. Cr.	No.	Course	Cl. Cr.
30-04	English Lit.	5 2½	43-21	Prin. of Mktg.	3 3	43-22	Prin. of Adv.	3
20-09	Int. to Stat. (Graphic Pres.)	3 (6) 3	44-20	Int. to Fin.	3 3	44-22	Prin. of Ins.	3
	or		45-21	Prin. of Bus. Mgt.	3 3	45-22	Prin. of Bus. Mgt.	3
47-09	Typing	3 (6) 3	41-27	Acctg. State.	4 4	41-28	Int. to Cost Acctg.	4
27-14	Hist. Civil.	4 2	25-01	Intro. to Psych.	4 4	25-02	Gen. Psych.	4
		12 (6) 7½			17 17			17

THIRD YEAR

TERM 7*			TERM 8			TERM 9		
No.	Course	Cl. Cr.	No.	Course	Cl. Cr.	No.	Course	Cl. Cr.
20-13	Econ. Prin.	8 4	20-14	Econ. Probs.	4 4	20-15	Econ. Probs.	4
26-07	Soc. Probs. or	8 4	29-01	Public Speaking	4 4	29-02	Public Speaking	4
14-41	Fund. of Math.	8 4	43-30	Salesmans'p	3 3	43-31	Copy Wtg.	3
		16 8	43-32	Sales Mgt.	3 3	43-33	Sales Mgt.	3
			44-31	Bus. Finance	4 4	44-32	Bus. Finance	4
					18 18			18

FOURTH YEAR

TERM 10*			TERM 11			TERM 12		
No.	Course	Cl. Cr.	No.	Course	Cl. Cr.	No.	Course	Cl. Cr.
24-40	El. of Phil.	5 2½	20-20	Statistics	3 (2) 4	20-21	Statistics	3 (2)
	Elective	5 2½	20-18	Am. Ec. Hist.	4 4	43-40	Advtg. Prod.	4
	Elective	5 2½	46-41	Leg. Asp. of Bus. I	4 4	46-42	Leg. Asp. of Bus. II	4
			43-44	For. Mktg.	2 2	30-17	Lit. (Shake- speare)	3
			43-43	Mktg. Res.	4 4	43-46	Cr. & Coll.	3
		15 7½			17 (2) 18			17 (2)

FIFTH YEAR

TERM 13*			TERM 14			TERM 15		
No.	Course	Cl. Cr.	No.	Course	Cl. Cr.	No.	Course	Cl. Cr.
24-41	Probs. of Phil.	5 2½	20-40	Bus. & Govt.	4 4	20-28	Comp. Ec. Sy.	4
	Elective	5 2½	43-61	Seminar in Mktg. & Advtg.	3 3		or	
	Elective	5 2½	43-53	Prob. in Adv.	3 3	20-65	Res. Meth.	4
			30-47	Mod. Novel	4 4	46-56	Law of Merch.	4
			23-06	Rec. Eur. Hist.	3 3	43-52	Ret. Merch.	4
			50-10	Place. Tech.	2 1	43-54	Prob. in Adv.	4
		15 7½			19 18		or	
						43-50	Ind. Mktg.	4
								16

*Summer term — 5 weeks. () indicate laboratory hours.

†All physically qualified male freshmen may elect ROTC if they so desire. Students accepted for the ROTC will not be required to take Physical Training in Terms 1, 2, 3, and will be permitted to substitute advanced ROTC courses for certain upperclass academic work as approved by the Dean up to a maximum of credits.

THE COLLEGE OF ENGINEERING

Aims and Methods

IT is the purpose of the College of Engineering to provide educational programs which will effectively prepare students to become professional practitioners, to enter graduate schools, or to accept employment in the many industrial fields in which an engineering background is helpful. Principally concerned with undergraduate instruction, the College is operated upon the Co-operative Plan and offers five-year curricula leading to the baccalaureate degree in civil, mechanical, electrical, chemical, and industrial engineering.

The academic program begins with a 30-week freshman year of full-time study during which the student continues to build the foundation in mathematics, the physical sciences, and means of expression that were begun in high school. Co-operative work in the same general field of engineering for which he is preparing begins with the second year and continues throughout the upperclass program. Thus the student has an opportunity to gain some insight into problems of actual engineering practice as he progresses through the course of study at the college.

In keeping with recent trends in engineering education, the co-operative curricula at Northeastern comprise a balanced sequence of courses in which the technological disciplines occupy about four-fifths of the student's program and the humanistic or general studies about one-fifth. These two aspects of the undergraduate curriculum are integrated throughout the entire five years so that growth in cultural understanding proceeds hand in hand with development of technical knowledge and skill. This plan, widely utilized in engineering education, is quite different from that in legal or medical education in which the general studies precede the professional training, but it has proved to be highly effective in the preparation of engineers and industrial leaders.

The courses of study in the first year are identical for all engineering students, and it is possible for a student to change his curriculum at the end of the freshman year without loss of time. Emphasis throughout all curricula is laid upon fundamental concepts and skills so that the student may develop an adequate foundation upon which to base his professional development. In the undergraduate programs relatively little time can be devoted to courses in specialized aspects of current engineering practice. These must in the main be given in graduate schools where specialization is appropriate and possible.

Undergraduate curricula at Northeastern are designed to develop young men and women with well-balanced personal qualities, a sense of civic responsibility, an understanding of industrial job requirements, and a technical competence sufficient to begin a professional career. Instruction both in the classroom and in the laboratory is designed to place maximum emphasis upon individual initiative and responsibility and to develop the student's powers of analysis.

Because an engineering education teaches the student to search out the truth, to think clearly, and to formulate conclusions based upon a solid foundation of facts, engineers are being called upon more and more to occupy positions of responsibility in the management of our great industrial enterprises. Even in such diverse fields as banking, public health, and public administration, this so-called engineering approach is in demand.

Day graduate programs are available in the Departments of Civil, Mechanical, and Electrical Engineering and of Physics leading to the Master's degree. The former are co-operative programs in engineering similar to the undergraduate co-operative programs. In Physics, conventional two-year half-time fellowships are available.

Admission Requirements

Applicants for admission to the freshman class must qualify by graduation from an approved course of study in an accredited secondary school, including the prescribed subjects listed on page 30.

Graduation Requirements

The College of Engineering offers five-year curricula, conducted on the Co-operative Plan, leading to the following degrees:

1. Bachelor of Science in Civil Engineering
2. Bachelor of Science in Mechanical Engineering
3. Bachelor of Science in Electrical Engineering
4. Bachelor of Science in Chemical Engineering
5. Bachelor of Science in Industrial Engineering

These curricula are described in the following pages. Since the first year is the same for all engineering students, final choice of curriculum need not be made until the beginning of the second year.

Candidates for the Bachelor of Science degree must complete all of the prescribed work of the curriculum in which they seek to qualify. A total of 232 credit hours (equivalent to 145 semester hours) is required for the degree. Students who undertake co-operative work assignments must meet the requirements of the Department of Co-operative Work before they become eligible for their degrees.

No student transferring from another college or university is eligible to receive the Bachelor of Science degree until he has completed at least one academic year at Northeastern immediately preceding his graduation.

Scholarship Requirements

The degree conferred not only represents the formal completion of the subjects in the selected course of study but also indicates professional competence in the designated field of specialization. Those who are clearly unable to meet the accepted standard of attainment will be required to withdraw from the University.

Graduation with Honor

Candidates who have achieved distinctly superior attainment in their academic work will be graduated with honor. Upon special vote of the faculty a limited number of this group may be graduated with high honor or with highest honor. Students must have been in attendance at the University at least three years before they may become eligible for honors at graduation.

Engineering Curricula

A brief description of each of the five engineering curricula together with a short statement as to the principal vocational opportunities available to graduates is given below to assist students in choosing their fields of specialization.

I. *Civil Engineering* has to do with the planning and building of all kinds of structures and public works. None of the structures of civil engineers lend themselves to quantity production in a factory. Not only are civil engineering works designed to fit a single location, but ordinarily their value is dependent upon their ability to resist forces tending to move them.

Civil engineering is as old as civilization itself and, until recent times, it embraced all phases of engineering except those of a military character. Today its major branches include topographical, municipal, railroad, highway, structural, hydraulic, and sanitary engineering. It covers land surveying, soil mechanics, the building of railroads, harbors, docks, and similar structures, the construction of sewers, water works, streets, and highways, the design and construction of flood control projects, bridges, buildings, walls, foundations, and of all fixed structures.

Since the first step in every civil engineering project involves accurate measurement of the surface features of the land, of the nature of the soil, and of the character of the underlying rock, the study of surveying and related subjects occupies a large place in the civil engineering curriculum. And since the primary consideration in designing any structure is to make certain that it will withstand safely any force to which it may be subjected, the mechanics of static bodies, strength of materials, and theory of structures are studied in detail. The curriculum is thus intended to prepare the young civil engineer to take up the work of design and construction of structures, to solve the problems of water supply and waste disposal in urban areas, and intelligently to undertake the supervision of work in allied fields of engineering and in general contracting.

Upon graduation, the young engineer may expect a period of apprenticeship either in the field, surveying and plotting, or in the office, over the drafting board. As experience is gained, the graduate is entrusted with greater responsibilities in actual design and supervision of construction. Those who prefer a roving existence should direct their ambitions toward private fields, while those who prefer a stable home and community life will seek opportunities in the public service of the Federal Government and the various states and municipalities.

II. *Mechanical Engineering* is concerned with the harnessing of power resources by means of machinery to perform useful work. With the increasing mechanization of all industry which has taken place during the last century, the field has so broadened as to include all lines of industry.

In contrast to the civil engineer who deals primarily with static forces, the mechanical engineer is more concerned with the mechanics of motion or kinetics. And because moving parts require constant care and adjustment, the mechanical engineer has the task not only of designing and installing complicated machinery but also of operating it efficiently after it has been installed.

The construction and operation of furnaces, boilers, and engines, the design of all kinds of machinery from pocket watches to steel mills, the construction and operation of railway and other transportation equipment including automobiles and airplanes, and even control of atmospheric conditions by means of heating and air conditioning equipment, all fall within the field of mechanical engineering.

Since machinery is so predominantly the concern of the mechanical engineer, the program of study is designed to give the student considerable training in the principles underlying the design and operation of engines, power transmission devices, machine tools, and other machinery. This, of course, implies a thorough study of the physical laws concerning motion and transfer of energy. Applied mechanics and thermodynamics occupy a prominent place in the curriculum. The program of instruction thus gives the student a broad foundation in those fundamental subjects essential to all engineering practice and, in the senior year, provides for limited specialization.

For those students desiring to specialize in the field of industrial management, attention is called to the curriculum in industrial engineering, the basic training of which is essentially the same as that in mechanical engineering.

The graduate mechanical engineer generally finds employment in an industrial plant, either in design and research or in plant operation and maintenance. And if his abilities lie in that direction, he frequently is entrusted after a time with greater and greater responsibility for the successful management of the enterprise.

III. Electrical Engineering is a fast-moving field, obtaining much of its impetus from the contemporary pioneering developments in the pure sciences. For this reason, the program of study in electrical engineering includes more work in physics and mathematics than do the other programs and provides as well a solid grounding in engineering fundamentals.

The field of electrical engineering, and the electrical industry which it services, are usually divided into two main areas — power and communications. These areas overlap in that both are concerned with electronics and control. The electrical engineering curriculum therefore, includes courses in the generation, transmission, and distribution of electrical energy for light and power purposes; the design and development of communications equipment such as telephones, radio, television, and radar; the development and operation of large-scale data-processing equipment and analog and digital computers; servomechanisms, etc. To provide the abstract ground necessary for these undertakings, courses covering Laplace transforms, field theory, and solid-state physics are included.

The profession of electrical engineering affords a wide diversification of employment opportunities. If one is research-minded, opportunity to develop one's talents may be found in one of the great university or industrial laboratories; if one is interested in industrial applications or plant problems, opportunity can be found in the manufacturing or operating organizations; and if one is sales-minded, he may find a career as a sales engineer.

IV. Chemical Engineering has grown out of the discoveries in the chemical laboratories which have served as a foundation for a great many new industries whose production processes involve chemical as well as physical changes. Petroleum refining, coal carbonization, plastics, manufacture of nylon and cellophane, and hundreds of other industries require men and women trained in chemistry as well as in engineering. Moreover, much of the training received by the chemical engineer is now being applied in the rapidly developing field of nuclear engineering. Many older industries such as foods, textiles, paints and varnishes, and leather are also employing chemical engineers.

The chemical engineer has been defined as a "professional man experienced in the design, construction, and operation of plants in which materials undergo chemical and physical change." It is the task of the chemical engineer to reduce the costs, increase production, and improve the quality of the products in the industry.

In addition to the fundamental courses in chemistry, mathematics, and physics required of all engineering students, a considerable amount of time is devoted to more advanced work in chemistry as a foundation for the study of chemical technology. In recognition of the increasing interest in the production and utilization of nuclear energy, a course in modern physics and a course in the introduction to nuclear engineering recently have been added to the curriculum. Instruction in the elements of mechanical and electrical engineering also helps to give the student a sound engineering background. Since the field of chemical engineering is so varied, the curriculum has been designed to give the students a broad training in which fundamental principles are stressed. It is believed that this training will enable the students readily to acclimate themselves to whatever industry they may choose to enter.

Because of the complex nature of many chemical processes and because of the difficulty of translating laboratory results into full-scale plant operations, there has been developed in many chemical plants the so-called semi-works or pilot plant. Here new processes developed by the chemists in the research laboratory are put to the test of actual plant conditions. And it is here that the young chemical engineers often find themselves upon graduation. If they are able to understand the chemist on the one side and the plant operator on the other, and if they are technically competent as well, they will soon find opportunities for advancement either in one of the technical branches of the industry, such as design, development, research, and production, or in the sales and management fields in which a knowledge of chemical engineering is essential.

V. Industrial Engineering is concerned with the application of engineering and scientific principles to the varied problems in the field of production management involving the intelligent utilization of men, materials, machines, and money.

About sixty years ago, Frederick W. Taylor undertook to apply to the problems of industrial management what we now call "the scientific method" or "the engineering approach." He reasoned that it was management's business to know what constituted a proper day's work and that the way to get the facts was through research and experiment on a scientific basis. He defined "scientific management" not as any device or scheme or gadget, but as a new outlook — a new viewpoint based upon a solid foundation of fact. The methods employed by

Taylor and by those who came after him have undergone some modification, but the concept of scientific management which he formulated has gained wider and wider recognition from both employers and employees.

This growing recognition of the value of a scientific approach to the problems of industrial management early created a demand for men and women trained in engineering and science, who possessed a knowledge of business as well, to assume positions of administrative responsibility in industry. To meet this demand, courses were established in many engineering colleges to provide a thorough training in engineering fundamentals together with a specialized training in business administration, which would prepare the students for managerial responsibilities in technical industries. These curricula are variously entitled industrial engineering, administrative engineering, or engineering administration, but all are designed to lead ultimately to positions of administrative or executive responsibility, rather than to positions which involve highly specialized technical engineering responsibility.

The curriculum in industrial engineering, then, provides a course of study which is essentially the same as that for mechanical engineering in the first three years. In the last two years, however, advanced engineering courses are replaced by courses in business management.

Upon graduation, the young industrial engineer may find his way into such factory staff departments as methods engineering, production planning and control, wage administration, quality control, or time study. If he prefers, he may select work in cost accounting or statistical analysis; then again he may incline towards sales engineering activity and serve in the "field" as a sales and service representative.

More and more there is opportunity for the experienced industrial engineer to serve industry in a consulting capacity. Upon becoming especially skilled in his profession, he is called in by industry for assistance in the installation and maintenance of sound management principles, and in the reorganization of enterprises which have failed.

Curriculum in Civil Engineering

FIRST YEAR†

TERM 1			TERM 2			TERM 3		
No.	Course		No.	Course		No.	Course	
01	Gen. Chem.	3 (3) 4	11-02	Gen. Chem.	3 (3) 4	11-03	Gen. Chem.	3 (3) 4
01	Eng'g Draw.	0 (6) 3	12-03	Desc. Geom.	0 (6) 3	12-02	Eng'g Draw.	0 (6) 3
51	Math. I	5 4	14-52	Math. II	5 4	14-53	Math. III	5 5
51	Physics	3 3	15-52	Physics	3 3	15-53	Physics	3 3
01	English	3 3	30-02	English	3 3	30-03	English	3 3
10	Phys. Ed.	0 (2) 0	16-11	Phys. Ed.	0 (2) 0	16-12	Phys. Ed.	0 (2) 0
		14(11) 17			14(11) 17			14(11) 18

COND YEAR

TERM 4*			TERM 5			TERM 6		
04	Gen. Chem.	3 (3) 2	1-10	Surveying	3 (3) 3	2-20	App. Mech.	4 4
04	Mach. Drwg.	0 (6) 2	3-01	Elec. Eng'g	3 3	3-02	Elec. Eng'g	3 3
54	Math. IV	5 2½	14-05	Diff. Calc.	4 4	14-06	Int. Calc.	4 4
54	Physics	5 2½	15-05	Physics	4 (3) 5	15-06	Physics	3 (3) 4
		13 (9) 9	23-30	Mod. Dem.	3 3	23-31	Mod. Dem.	3 3
					17 (6) 18			17 (3) 18

THIRD YEAR

TERM 7*			TERM 8			TERM 9		
21	App. Mech.	6 3	1-11	Surveying	4 (3) 4	1-12	Surveying	3 (3) 3
07	Psychology	6 3	2-22	Str. of Mat.	4 4	1-20	Hydraulics	3 3
15	Literature	6 3	2-80	Heat Eng'g	4 4	2-23	Str. of Mat.	3 3
			3-03	Elect. Eng'g	3 3	14-07	Diff. Eq.	4 4
			20-11	Economics	3 3	20-12	Economics	3 3
		18 9			18 (3) 18	44-13	Constr. Fin.	2 2
								18 (3) 18

FOURTH YEAR

TERM 10*			TERM 11			TERM 12		
13	Surveying	2(12) 3	1-21	Hydraulics	3 3	1-41	Struct. Anal.	4 4
08	Psychology	6 3	1-40	Struct. Anal.	3 3	1-50	Concrete	3 3
16	Literature	6 3	1-49	Conc. T. Lab.	1 (4) 3	1-54	Des. of Struc.	2 (4) 2
			2-24	Adv. Mech.	3 3	1-58	Eng'g Geol.	3 3
			2-43	Mat. and Proc.	3 3	2-64	Test. Mat. Lab.	1 (4) 3
			Lib. Elect.	3 3		Lib. Elect.	3 3	
		14(12) 9			16 (4) 18			16 (8) 18

FIFTH YEAR

TERM 13*			TERM 14			TERM 15		
03	Eff. Speaking	6 3	1-24	San. Eng'g	4 4	1-25	San. Eng'g	3 (3) 4
03	Contracts and Agency	6 3	1-30	Transport.	3 3	1-31	Transport.	2 2
Lib. Elect.	6 3		1-42	Struct. Anal.	3 3	1-43	Struct. Anal.	4 4
			1-51	Concrete	4 4	1-56	Des. of Str.	0 (9) 3
			1-55	Des. of Str.	3 (6) 3	1-57	Found. Eng'g	2 2
			50-01	Prof. Devel.	3 1	1-60	Cons. Cost	3 3
		18 9			20 (6) 18			14(12) 18

Summer term — 5 weeks. () indicate laboratory hours.

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Curriculum in Mechanical Engineering

FIRST YEAR†

TERM 1			TERM 2			TERM 3		
No.	Course	Cl. Cr.	No.	Course	Cl. Cr.	No.	Course	Cl.
11-01	Gen. Chem.	3 (3) 4	11-02	Gen. Chem.	3 (3) 4	11-03	Gen. Chem.	3 (3)
12-01	Eng'g Draw.	0 (6) 3	12-03	Desc. Geom.	0 (6) 3	12-02	Eng'g Draw.	0 (6)
14-51	Math. I	5 4	14-52	Math. II	5 4	14-53	Math. III	5
15-51	Physics	3 3	15-52	Physics	3 3	15-53	Physics	3
30-01	English	3 3	30-02	English	3 3	30-03	English	3
16-10	Phys. Ed.	0 (2) 0	16-11	Phys. Ed.	0 (2) 0	16-12	Phys. Ed.	0 (2)
14(11) 17			14(11) 17			14(11)		

SECOND YEAR

TERM 4*			TERM 5			TERM 6		
No.	Course	Cl. Cr.	No.	Course	Cl. Cr.	No.	Course	Cl.
11-04	Gen. Chem.	3 (3) 2	3-01	Elect. Eng'g	3 3	2-20	App. Mech.	4
12-04	Mach. Draw.	0 (6) 2	14-05	Diff. Calc.	4 4	3-02	Elect. Eng'g	3
14-54	Math. IV	5 2½	15-05	Physics	4 (3) 5	14-06	Int. Calc.	4
15-54	Physics	5 2½	23-30	Mod. Dem.	3 3	15-06	Physics	3 (3)
13 (9) 9			30-15	Literature	3 3	23-31	Mod. Dem.	3
			17 (3) 18			17 (3)		

THIRD YEAR

TERM 7*			TERM 8			TERM 9		
No.	Course	Cl. Cr.	No.	Course	Cl. Cr.	No.	Course	Cl.
1-10	Surveying	6 (6) 3	2-22	Str. of Mat.	4 4	1-20	Hydraulics	3
2-21	App. Mech.	6 3	2-81	Heat Eng'g	4 4	2-13	Mechanism	3
25-07	Psychology	6 3	3-03	Elect. Eng'g	3 3	2-23	Str. of Mat.	3
18 (6) 9			14-07	Diff. Eq.	4 4	2-82	Heat Eng'g	3
			20-11	Economics	3 3	14-20	Adv. Math.	3
			18 18			20-12	Economics	3
						18		

FOURTH YEAR

TERM 10*			TERM 11			TERM 12		
No.	Course	Cl. Cr.	No.	Course	Cl. Cr.	No.	Course	Cl.
2-83	Heat Eng'g	6 3	2-27	Fluid Mech.	3 3	2-24	Adv. Mech.	3
25-08	Psychology	6 3	2-43	Mats. and Proc.	3 3	2-28	Fluid Mech.	3
30-16	Literature	6 3	2-84	Heat Eng'g	4 4	2-61	Mech. E. Lab.	0 (3)
18 9			2-60	Mech. E. Lab.	0 (3) 2	2-85	Heat Eng'g	4
			5-10	Ind. Mgt.	3 3	5-11	Ind. Mgt.	3
			Lib. Elect.	3 3	Lib. Elect.	3		
			16 (3) 18			16 (3)		

FIFTH YEAR

TERM 13*			TERM 14			TERM 15		
No.	Course	Cl. Cr.	No.	Course	Cl. Cr.	No.	Course	Cl.
2-46	Metal Proc.	4 (6) 3	1-46	Structures	3 3	1-47	Structures	3
29-03	Eff. Speaking	6 3	2-14	Mach. Design	3 (3) 4	2-15	Mach. Design	3 (3)
Lib. Elect.	6 3		2-26	Eng. Dyn.	3 3	2-44	Phys. Met.	3 (3)
16 (6) 9			2-86	Heat Eng'g	4 4	2-63	Mech. E. Lab.	0 (4)
			2-62	Mech. E. Lab.	0 (4) 3	2-87	Power Plant Eng'g	4
			50-01	Prof. Devel.	3 1	13(10)		
			16 (7) 18					

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Curriculum in Electrical Engineering

FIRST YEAR†

TERM 1			TERM 2			TERM 3		
No.	Course	Cl. Cr.	No.	Course	Cl. Cr.	No.	Course	Cl. Cr.
1-01	Gen. Chem.	3 (3) 4	11-02	Gen. Chem.	3 (3) 4	11-03	Gen. Chem.	3 (3) 4
1-01	Eng'g Draw.	0 (6) 3	12-03	Desc. Geom.	0 (6) 3	12-02	Eng'g Draw.	0 (6) 3
1-51	Math. I	5 4	14-52	Math. II	5 4	14-53	Math. III	5 5
1-51	Physics	3 3	15-52	Physics	3 3	15-53	Physics	3 3
1-01	English	3 3	30-02	English	3 3	30-03	English	3 3
1-10	Phys. Ed.	0 (2) 0	16-11	Phys. Ed.	0 (2) 0	16-12	Phys. Ed.	0 (2) 0
14(11) 17			14(11) 17			14(11) 18		

SECOND YEAR

TERM 4*			TERM 5			TERM 6		
2-04	Gen. Chem.	3 (3) 2	3-51	Elec. Eng'g I	3 3	2-20	App. Mech.	4 4
2-04	Mach. Draw.	0 (6) 2	14-05	Diff. Calc.	4 4	3-52	Elec. Eng'g II	3 3
1-54	Intro. Calc.	5 2½	15-05	Physics	4 (3) 5	14-06	Int. Calc.	4 4
1-54	Physics	5 2½	23-30	Mod. Dem.	3 3	15-06	Physics	3 (3) 4
13 (9) 9			30-15	Literature	3 3	23-31	Mod. Dem.	3 3
			17 (3) 18			17 (3) 18		

THIRD YEAR

TERM 7*			TERM 8			TERM 9		
2-21	App. Mech.	6 3	2-22	Str. of Mat.	4 4	1-20	Hydraulics	3 3
1-53	Elec. Eng'g III	6 3	2-43	Mat. and Proc.	3 3	2-80	Heat Eng'g	4 4
1-07	Psychology	6 3	3-54	Elec. Eng. IV	4 3	3-70	Electronics I	3 3
18 9			14-07	Diff. Eq.	4 4	14-20	Adv. Math.	3 3
			20-11	Economics	3 3	20-12	Economics	3 3
			18 17			30-16	Literature	3 3
						19 19		

FOURTH YEAR

TERM 10*			TERM 11			TERM 12		
3-90 Elec. E. Lab. I	2 (6)	3	3-15 Polyphase			3-55 Elec. Mach. I	3	3
3-80 Transients	6	3	A.C. Circ.	3	3	3-92 Elec. E. Lab. III	1 (3)	3
5-08 Psychology	6	3	3-91 Elec. E. Lab. II	1 (3)	3	3-93 Elec. E. Lab. IV	1 (3)	3
			3-19 El. F'ld Theo.	3	3	3-29 Ad. F'ld Theo.	3	3
			3-71 Electronics II	3	3	3-72 Electronics III	3	3
			5-03 Ind. Mgt.	3	3	Lib. Elect.	3	3
			Lib. Elect.	3	3			
	14 (6)	9		16 (3)	18		14 (6)	18

FIFTH YEAR

TERM 13*			TERM 14			TERM 15		
3-94	Elec. E. Lab. V	4 (12) 6	3-56	Elec. Mach. II	3 3	3-57	Elec. Mach. III	3 3
Lib. Elect.	6 3		3-73	Electronics IV	3 3	3-74	Electronics V	3 3
10 (12) 9			3-28	Trans. Lines	4 4	3-32	Filters	3 3
			3-60	Servo	3 3	3-96	Elec. E. Lab. VII	1 (3) 3
			3-95	Elec. E. Lab. VI	2 (3) 4	29-03	Eff. Speaking	3 3
			50-01	Prof. Devel.	3 1	46-03	Contracts and Agency	3 3
			18 (3) 18			16 (3) 18		

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Curriculum in Chemical Engineering

FIRST YEAR†

TERM 1

No.	Course	Cl.	Cr.
11-01	Gen. Chem.	3 (3)	4
12-01	Eng'g Draw.	0 (6)	3
14-51	Math. I	5	4
15-51	Physics	3	3
30-01	English	3	3
16-10	Phys. Ed.	0 (2)	0
		14 (11)	17

TERM 2

No.	Course	Cl.	Cr.
11-02	Gen. Chem.	3 (3)	4
12-03	Desc. Geom.	0 (6)	3
14-52	Math. II	5	4
15-52	Physics	3	3
30-02	English	3	3
16-11	Phys. Ed.	0 (2)	0
		14 (11)	17

TERM 3

No.	Course	Cl.
11-03	Gen. Chem.	3 (3)
12-02	Eng'g Draw.	0 (6)
14-53	Math. III	5
15-53	Physics	3
30-03	English	3
16-12	Phys. Ed.	0 (2)
		14 (11)

SECOND YEAR

TERM 4

11-05	Gen. Chem.	3 (3)	2
4-50	Intro. to Chem. Eng.	4	2
14-54	Math. IV	5	2½
15-54	Physics	5	2½
		17 (3)	9

TERM 5

11-51	Organic	3 (6)	5
14-05	Diff. Calc.	4	4
15-05	Physics	4 (3)	5
4-51	Chem. E. Lit.	1	1
23-30	Mod. Dem.	3	3
		15 (9)	18

TERM 6

11-54	Organic	3
14-06	Int. Calc.	4
15-06	Physics	3 (3)
2-20	App. Mech.	4
23-31	Mod. Dem.	3
		17 (3)

THIRD YEAR

TERM 7*

2-21	App. Mech.	6	3
4-60	Fluid Mechanics	5 (3)	3
30-16	Literature	6	3
		17 (3)	9

TERM 8

2-22	Str. of Mat.	4	4
11-61	Phys. Chem.	3 (3)	4
30-15	Literature	3	3
14-07	Diff. Eq.	4	4
20-11	Economics	3	3
		17 (3)	18

TERM 9

4-52	Chem. Eng. Calc.	4
11-62	Phys. Chem.	3 (3)
15-41	Int. At. Nuc. Phys.	4
14-20	Adv. Math.	3
20-12	Economics	3
		17 (3)

FOURTH YEAR

TERM 10*

4-70	Heat Trans.	5 (3)	3
25-07	Psychology	6	3
29-03	Eff. Speaking	6	3
		17 (3)	9

TERM 11

11-65	Phys. Chem.	3	3
4-71	Chem. Eng'g	4 (4)	6
	Lib. Elect.	3	3
4-61	Ch. Eng. Therm.	3	3
11-73	Analyt. Chem.	2 (3)	3
		15 (7)	18

TERM 12

11-56	Organic	3
4-72	Chem. Eng'g	4 (4)
	Lib. Elect.	3
4-62	Ch. Eng. Therm.	4
4-42	Prop. of M'tls	2
		16 (4)

FIFTH YEAR

TERM 13*

25-08	Psychology	6	3
	Lib. Elect.	6	3
4-80	Proc. Eng. Econ.	6	3
		18	9

TERM 14

3-04	Elec. Eng.	3 (3)	4
4-63	Ch. Eng. Kinet.	4	4
4-43	Eng'g M'tls	3	3
4-91	Process D'sn	1 (6)	6
	or		
4-93	Projects	1 (6)	6
50-01	Prof. Dev.	3	1
		14 (9)	18

TERM 15

3-05 Elec. Eng.	3
4-46 Int. Nuc. Eng.	4
4-82 Ch. Plant Cost	3
4-92 Process D'sn	0 (6)
or	
4-94 Projects	0 (6)
4-44 Ind. Processes	3
	<hr/>
	13 (6)

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Curriculum in Industrial Engineering

FIRST YEAR†

TERM 1			TERM 2			TERM 3		
Course	Cl.	Cr.	No. Course	Cl.	Cr.	No. Course	Cl.	Cr.
01 Gen. Chem.	3 (3)	4	11-02 Gen. Chem.	3 (3)	4	11-03 Gen. Chem.	3 (3)	4
01 Eng'g Draw.	0 (6)	3	12-03 Desc. Geom.	0 (6)	3	12-02 Eng'g Draw.	0 (6)	3
51 Math. I	5	4	14-52 Math. II	5	4	14-53 Math. III	5	5
51 Physics	3	3	15-52 Physics	3	3	15-53 Physics	3	3
01 English	3	3	30-02 English	3	3	30-03 English	3	3
10 Phys. Ed.	0 (2)	0	16-11 Phys. Ed.	0 (2)	0	16-12 Phys. Ed.	0 (2)	0
	14(11)	17		14(11)	17		14(11)	18

COND YEAR

TERM 4*			TERM 5			TERM 6		
Course	Cl.	Cr.	No. Course	Cl.	Cr.	No. Course	Cl.	Cr.
04 Gen. Chem.	3 (3)	2	3-01 Elec. Eng'g	3	3	2-20 App. Mech.	4	4
04 Mach. Draw.	0 (6)	2	14-05 Diff. Calc.	4	4	3-02 Elec. Eng'g	3	3
54 Math. IV	5	2½	15-05 Physics	4 (3)	5	14-06 Int. Calc.	4	4
54 Physics	5	2½	23-30 Mod. Dem.	3	3	15-06 Physics	3 (3)	4
			30-15 Literature	3	3	23-31 Mod. Dem.	3	3
	13 (9)	9		17 (3)	18		17 (3)	18

THIRD YEAR

TERM 7*			TERM 8			TERM 9		
Course	Cl.	Cr.	No. Course	Cl.	Cr.	No. Course	Cl.	Cr.
21 App. Mech.	6	3	2-22 Str. of Mat.	4	4	1-20 Hydraulics	3	3
07 Psychology	6	3	2-81 Heat Eng'g	4	4	2-23 Str. of Mat.	3	3
16 Literature	6	3	5-10 Ind. Mgt.	3	3	2-82 Heat Eng'g	3	3
			14-07 Diff. Eq.	4	4	3-03 Elect. Eng'g	3	3
			20-11 Economics	3	3	5-11 Ind. Mgt.	3	3
	18	9		18	18	20-12 Economics	3	3

FOURTH YEAR

TERM 10*			TERM 11			TERM 12		
Course	Cl.	Cr.	No. Course	Cl.	Cr.	No. Course	Cl.	Cr.
22 Proc. Plan. & Tool Design	5 (5)	3	1-21 Hydraulics	3	3	2-13 Mechanism	3	3
22 Ind. Stat. I	4 (4)	3	2-43 Mat. and Proc.	3	3	5-12 Meth. Time An.	3 (3)	4
08 Psychology	6	3	5-09 Ind. Stat. II	4	3	41-35 Ind. Acct.	5	5
			5-17 Prod. Plan. and Cont.	3	3	5-19 Pers. Admin.	3	3
			41-34 Ind. Acctg. Lib. Elect.	3	3	Lib. Elect.	3	3
	15 (9)	9		19	18		17 (3)	18

FIFTH YEAR

TERM 13*			TERM 14			TERM 15		
Course	Cl.	Cr.	No. Course	Cl.	Cr.	No. Course	Cl.	Cr.
30 Determinants & Matrices	5	3	5-27 Operations Research	4	4	2-44 Phys. Met.	3 (3)	4
03 Contracts & Agency	6	3	2-67 Mech. E. Lab.	0 (4)	3	5-23 Plant Layout & Mat. Hdlg.	3 (6)	5
Lib. Elect.	6	3	5-13 Meth. Time An.	3 (3)	4	5-25 Eng'g Econ.	4	4
			5-18 Qual. Cont.	3 (2)	3	5-26 Seminar	2	2
			5-20 Wage Admin.	3	3	29-03 Eff. Speaking	3	3
			50-01 Prof. Devel.	3	1			
	17	9		16 (9)	18		15 (9)	18

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COURSES OF INSTRUCTION

On the pages which follow are given in numerical order the synopses of courses offered in the several curricula of the Day Colleges. Although not all courses are offered every year, all will be offered during the normal period of each student's curriculum. The term "preparation" indicates a course that must be taken before undertaking the advanced course to which it applies.

A credit hour equals approximately three clock hours of work: ordinarily one hour of class and two hours of preparation a week for a term of 10 weeks. Laboratory and drawing courses normally require fewer hours of outside preparation and, therefore, carry less credit than lecture courses. Since the summer terms are only 5 weeks long, courses offered in the summer carry one-half of the credits carried by courses which meet the same number of hours per week in the regular 10-week terms. Credit hours can be converted into standard semester hours by multiplying by 10/16, the ratio of the number of weeks in the term to the usual number of weeks in the semester.

The University reserves the right to withdraw, modify, or add to the courses offered or to change the order or content of courses in any curriculum.

Civil Engineering

1-10 *Surveying* — This first course in surveying is divided into two portions: classroom instruction and surveying field work.

Basic surveying principles are stressed in the lecture portion of this course covering the following topics: taping, the compass, the level, differential leveling, profile leveling, the transit, closed traverse, stadia, traverse calculations, and plotting of survey data.

The surveying field work portion of this course covers such topics as taping, differential leveling, running closed traverse, and the location of physical details from the closed traverse by angle and distance or by stadia. Prep. 14-53, 3 Class Hrs.; 3 Lab. Hrs.; 3 Credit Hrs.

1-11 *Surveying* — Like Course 1-10, this course in surveying is divided into two portions: classroom instruction and the drafting room.

Simple, compound, and reverse horizontal curves, and spiral easement curves, both from the standpoint of a railroad curve and of a circular arc, are studied. Also included in the classroom instruction are vertical curves and earthwork solutions.

In the drafting room, data collected in the field portion of Course 1-10 are calculated as a closed traverse, plotted, and traced as a finished plan. Prep. 1-10; 4 Class Hrs.; 3 Lab. Hrs.; 4 Credit Hrs.

1-12 *Surveying* — This course is a continuation of Course 1-11 and it is divided into classroom instruction and field surveying.

In the classroom the following are studied: a review of spherical trigonometry; observations on the sun for latitude, time, and azimuth; and the basic principles of photogrammetry and geodesy.

The field work consists of a random traverse being run, from which the physical details are located. A map is prepared, using collected data; a location line determined, and then the location line is staked out, with a profile of the location line being run. Prep. 1-11; 3 Class Hrs.; 3 Lab. Hrs.; 3 Credit Hrs.

1-13 Surveying — This course, likewise, is divided into two portions: classroom instruction and surveying practice (field and office work).

In the classroom, the theory and use of the plane table, precise leveling, precise taping, and use of the Ephemeris tables are studied.

The surveying practice portion includes the following: precise and Coast and Geodetic leveling; cross sections; earthworks calculations; mass diagram solution; plane table problems; observations on the sun for latitude, time, and azimuth; observation on Polaris for azimuth; and basic problems of photogrammetry including differential parallax measurements. Prep. 1-12; 2 Class Hrs.; 12 Lab. Hrs.; 3 Credit Hrs.

1-20 Hydraulics — A basic course in hydraulics dealing with the laws of hydrostatics and hydrokinetics.

In hydrostatics the following topics are studied: pressure gauges; differential manometers; pressure intensities; total pressures; location of center of pressure (horizontally and vertically); total pressures on curved and inclined surfaces; hoop tension and end tension; simple dams; and flotation problems.

While in hydrokinetics, Bernoulli's theorem; the Venturi meter, orifices; short tubes; pipe lines; and open channel flow are studied. Prep. 2-21; 3 Class Hrs.; 3 Credit Hrs.

1-21 Hydraulics — This course is a continuation of Course 1-20, where the following subjects are studied: equivalent pipes; the Hardy Cross method of analysis; weirs; dimensional analysis; model analysis by Froude's number and by Reynold's number; flow of fluids through closed conduits; the hydraulic jump; and the drawdown and backwater curves. Prep. 1-20; 3 Class Hrs.; 3 Credit Hrs.

1-24 Sanitary Engineering — This is a general course in water supply engineering where the following items are studied: forecasting the future population; the quality and quantity of water; rainfall; runoff; the collection and storage of ground water and surface water supplies; slow sand and rapid sand filters; treatment of waters for the removal of hardness, iron, and other impurities; disinfection of waters; and the distribution system. Prep. 1-21; 4 Class Hrs.; 4 Credit Hrs.

1-25 Sanitary Engineering — This is a companion course to 1-24. It deals with the collection and disposal of sewage and storm water, including the following items: the quantity of sewage and storm water; sewerage systems; the collection of data necessary for design and construction of collection systems; and a discussion of the modern methods of sewage treatment and the operation of these treatment plants.

The laboratory portion of this course is designed to familiarize the student with the proper method of collecting, storing, and transporting water and sewage samples; and the basic principles of water and sewage analysis for both chemical and sewage samples; and the basic principles of water and sewage analysis for both chemical and bacterial properties. Prep. 1-24; 3 Class Hrs.; 3 Lab. Hrs.; 4 Credit Hrs.

1-30 *Transportation* — This course consists of a discussion of traffic engineering, administration, surveys, and plans of modern highways. The economics of highway rates of grade and general layout features, such as vertical curves, horizontal curves, superelevation, traffic control, accidents, and general highway safety are discussed.

Roadway foundations, grading, and excavating equipment as well as highway drainage problems are also considered.

A study is made of soil tests and classifications. The elementary principles of soil mechanics as they are applied to highway and airport design and construction are considered.

The manufacture and testing of bituminous products as well as the construction of low cost road types (earth and gravel) and methods of soil stabilization are included. Prep. 1-12; 3 Class Hrs.; 3 Credit Hrs.

1-31 *Transportation* — A course which is a continuation of 1-30 and includes a detailed discussion of the design and construction of the higher cost types of roadways such as penetrated macadam, Portland cement concrete, and asphaltic concrete pavements. A brief discussion of airport design and layout concludes the course.

The application of the latest research developments is considered throughout all phases of the material as given in both this course and 1-30. Prep. 1-30; 2 Class Hrs.; 2 Credit Hrs.

1-40 *Structural Analysis* — This, the first of a series of four courses in structural analysis, is devoted to a review and expansion of algebraic and graphical methods of determining reactions, shears, bending moments, and stresses developed by loads acting upon all forms of planar and statically determinate beams and frame structures. Prep. 2-22; 3 Class Hrs.; 3 Credit Hrs.

1-41 *Structural Analysis* — A continuation of 1-40, covering a discussion of roof loads encountered in practice and the determination of design stresses for a typical roof truss. Consideration is given to the various types of girder, simple truss, and subdivided truss, highway and railway bridges embracing the treatment of dead load stresses developed in such structures. A complete study of influence lines is undertaken, together with their function in determining the shears, bending moments, and stresses produced by moving load systems, both distributed and concentrated, with attention to their dynamic or impact effect. Upon conclusion of these studies a discussion of design stresses is included. Prep. 1-40; 4 Class Hrs.; 4 Credit Hrs.

1-42 *Structural Analysis* — A continuation of 1-41, covering the slope and deflection of beams and girders due to bending, by the method of work, the moment-area process, and the method of elastic weights. The deflection of statically determinate framed structures is studied by the method of work and by the Williot-Mohr process. Prep. 1-41; 3 Class Hrs.; 3 Credit Hrs.

1-43 *Structural Analysis* — Continuation of 1-42, embracing the analysis of continuous beams, simple statically indeterminate trusses and frameworks (without and with side sway) by the methods of least work, slope-deflection, and moment distribution.

A study is made of the shears, moments, and stresses developed in tall building frames by the various approximate methods of treatment. Prep. 1-42; 4 Class Hrs.; 4 Credit Hrs.

1-46 *Structures* — This course, designed for mechanical engineering students, comprises a study of loads and the analysis of ordinary building frames and trusses encountered in this field. The complete determination of design stresses for a typical roof truss is carried out. Assumptions for making approximate solutions of mill building bents are considered. The use of influence lines for stress analysis under moving loads is studied. The application of influence lines to simple and overhanging beams is stressed. Maximum shears and moments due to moving, concentrated, and distributed loads are considered, as well as the absolute maximum moment in a beam. Prep. 2-23; 3 Class Hrs.; 3 Credit Hrs.

1-47 *Structures* — This course covers the basic principles and assumptions of structural design for a clearer understanding of design problems encountered in mechanical engineering. It consists of the theory and practice of designing connections for various structural elements, using rivets and welds. It also deals with the design of tension and compression members, giving consideration to direct and flexural stresses. A complete study of a plate girder for a building is made. Prep. 1-46; 3 Class Hrs.; 3 Credit Hrs.

1-49 *Concrete Testing Laboratory* — This laboratory course covers the testing (ASTM and AASHTO Standards) of Portland Cement concrete and aggregates used in making concrete.

The tests on the aggregates (fine and coarse) consist of specific gravity, absorption, surface moisture, mortar-making properties, organic impurities, bulking, unit weight, and abrasion loss (Los Angeles).

Concrete mix variables such as the water-cement ratio law, effect of varying percentages of sand and varying maximum size aggregate on the cement factor are studied by means of laboratory exercises. Strength is determined by compression and flexural testing.

The strength-developing characteristics of the different cement types, effect of curing temperature, and methods of curing as well as air-entrained concrete are included in the laboratory work.

Complete reports are required at the conclusion of all tests. Prep. 2-23; 1 Class Hr.; 4 Lab. Hrs.; 3 Credit Hrs.

1-50 *Concrete* — The fundamental principles involved in the theory of reinforced concrete behavior are thoroughly reviewed and investigated, and the transformed area method of analysis and design is developed. This is followed by the application of this method to the analysis and design of elementary members such as rectangular beams, tee beams, and beams reinforced in compression. Shear, bond, and anchorage are also treated. In addition, a discussion of specifications and current practice is included. Prep. 2-23, 1-49; 3 Class Hrs.; 3 Credit Hrs.

1-51 *Concrete* — This course, a continuation of 1-50, beginning with a study of the effects of diagonal tension and the design of vertical and inclined stirrups. The analysis and design of axially loaded columns on the basis of elastic behavior, followed by consideration of the influence of shrinkage and plastic flow. A com-

plete analysis of members subjected to combined bending and axial effects are studied. At this stage formulas and graphs are developed for aids in designing. Methods of analysis for the design of the most frequent types of continuous reinforced concrete structures are considered. The interpretation of the "ACI Building Code Requirements for Reinforced Concrete" as affecting such construction is carried on throughout this course. Prep. 1-50; 4 Class Hrs.; 4 Credit Hrs.

1-54 *Design of Structures* — This first course consists of lectures and problem work in the theory and practice of designing connections for various structural elements using rivets and welding. Connections with concentric and eccentric loadings are considered. Prep. 2-23; 2 Class Hrs.; 4 Lab. Hrs.; 2 Credit Hrs.

1-55 *Design of Structures* — This course, a continuation of 1-54, considers the design of moment connections for fixed ended beams. Following this, the work consists principally of the design of the individual members in a structural framework such as tension members, compression members, and flexural members. In the design of these members the effect of combined loadings is carefully considered. Shop drawings are made for the members as designed. Prep. 1-54; 3 Class Hrs.; 6 Lab. Hrs.; 3 Credit Hrs.

1-56 *Design of Structures* — This course, the third one in the Design series, treats the complete design and drawing of a plate girder for a building or bridge. The tabular or office procedure method of design of reinforced concrete beams is developed. The design of reinforced concrete footings, both isolated and combined, are included. The design of continuous beams, both steel and concrete, concludes the course. Prep. 1-55; 9 Lab. Hrs.; 3 Credit Hrs.

1-57 *Foundation Engineering* — By means of lectures and assigned readings, the following topics are considered: types of piles, pile driving equipment, pile loading capacity, marine borers, various types of caissons, cofferdams, methods of underpinning, and ground water control in foundation construction. Consideration is given to dredging operations.

The latest developments in the field of soil mechanics as related to the above topics are treated. 2 Class Hrs.; 2 Credit Hrs.

1-58 *Engineering Geology* — A discussion of the important minerals in the earth's surface, classification of rocks, geologic structure of the rocks including rock weathering. Other topics considered are subsurface water, landslides, river and river action, shore lines and beaches, dams and reservoirs, as well as geological maps. In all topics discussed, the engineering phases will be emphasized. 3 Class Hrs.; 3 Credit Hrs.

1-60 *Construction Costs* — This course begins with an introduction to the organization of the construction industry and companion matters. There follows a discussion of approximate and detailed estimate of construction cost methods, both direct and indirect. Types of construction agreements by contract, day labor, etc., are examined, as well as bidding procedure. Some consideration is given to cost keeping, reports, debt retirement, and depreciation as affecting costs. 3 Class Hrs.; 3 Credit Hrs.

Mechanical Engineering

2-13 *Mechanism* — Mathematical and graphical solutions of problems of linear and angular velocities, vector analysis, linkages, cams, rolling contact, gears, gear tooth design, epicyclic trains, belt rope and chain drives, and miscellaneous motions. Prep. 2-21; 3 Class Hrs.; 3 Credit Hrs.

2-14 *Machine Design* — Application of theoretical principles previously studied to familiarize the student with practical details which must be considered in design work, such as keys, pins, cotters, press and shrink fits, weldments, chains, and brakes. Prep. 2-24, 2-43; 3 Class Hrs.; 3 Lab. Hrs.; 4 Credit Hrs.

2-15 *Machine Design* — A continuation of the application of theoretical mechanics and materials to problems of lubrication; leaf springs; helical springs; shafting; couplings; crankshafts; flywheels; spur, helical, and worm gearing; and dynamic loading. Prep. 2-14; 3 Class Hrs.; 3 Lab. Hrs.; 4 Credit Hrs.

2-20 *Applied Mechanics (Statics)* — Analysis of colinear, parallel, concurrent, and non-concurrent force systems in two and three dimensions; the determination of the resultant of such systems by both algebraic and graphical methods, the string polygon method being used for coplanar systems. In addition, friction, first and second moments, including the allied topics of radius of gyration, polar moments, transfer of axes, rotation of axes, and principal axes, are considered. Prep. 14-05, 15-02; 4 Class Hrs.; 4 Credit Hrs.

2-21 *Applied Mechanics (Kinetics)* — Kinetics and dynamics of bodies in translation, pure rotation, and general plane motion under conditions of uniform or variable acceleration, including discussion of center of percussion, work and energy, linear and angular momentum, impulse and impact. Prep. 2-20, 14-06; 6 Class Hrs.; 3 Credit Hrs.

2-22 *Strength of Materials* — Definition and discussion of unit stress and strain, physical properties of materials, the stress-strain diagram, axially loaded members, resilience, indeterminate axially loaded members, stresses in thin cylinders and spheres, riveted and welded connectors, torsion in circular members, shear and bending moments in beams, bending stresses in beams, and beam design. Prep. 2-21; 4 Class Hrs.; 4 Credit Hrs.

2-23 *Strength of Materials* — Derivation of the elastic curve for determinate and indeterminate beams under various systems of loading both by the double integration and by the moment area methods; derivation of the Theorem of Three Moments and its application to continuous beams; combined bending and axial loads; column action, and the elastic energy theory. Prep. 2-22, 3 Class Hrs.; 3 Credit Hrs.

2-24 *Advanced Mechanics* — Analysis of stress at a point by analytical and graphical (Mohr's Circle) methods with emphasis on plane stress; theories of failure; and their applications to such problems as thick hollow cylinders, shafting under combined bending and twisting, curved bars in bending, non-symmetrical bending, non-circular bars in torsion, and flat plates. Prep. 2-23; 3 Class Hrs.; 3 Credit Hrs.

2-26 *Engine Dynamics* — Review of momentum principles and the application to gyroscopes; development and applications of Coriolis' law; balancing of rotating parts; a detailed treatment of vibrations involving the single degree of freedom for free or forced vibrations, with or without damping of viscous or Coulomb type; and an introduction to problems involving more than single degree of freedom. Prep. 2-21, 14-20; 3 Class Hrs.; 3 Credit Hrs.

2-27 *Fluid Mechanics* — Flow through weirs; dimensional analysis; model analysis; flow of fluids through closed conduits; impulse and momentum as applied to fluid flow; applications to pumps and hydraulic turbines. Prep. 1-20; 3 Class Hrs.; 3 Credit Hrs.

2-28 *Fluid Mechanics* — Dimensional analysis and linear momentum; two-dimensional flow of an ideal fluid; superposition of flow patterns as a preliminary to the Kutt-Joukowski lift theorem for flow past a rotating cylinder; extension of the theory to three dimensions; including the Prandtl vortex theory, von Karman vortex sheet, and the elementary boundary layer theory. Prep. 1-22 (or 2-27), 14-20; 3 Class Hrs.; 3 Credit Hrs.

2-43 *Materials and Production Processes* — The physical properties, composition, and methods of production of the ferrous and non-ferrous metals and their alloys; plastics; timber; lime, cement, and concrete; the selection of materials for specific service; and the techniques, processes, and machines used in the manufacture of articles including the processes of welding, hot and cold working, die casting, and modern foundry practice. Prep. 11-04; 3 Class Hrs.; 3 Credit Hrs.

2-44 *Physical Metallurgy* — The relation between the crystalline structures and the physical properties of metals; the theory of crystallization and some of the equilibrium diagrams of the ferrous and non-ferrous metals; the preparation by polishing and etching of metallic specimens for examination by microscope and metallograph; the heat treatment methods in use for the common metals and their effects on the crystalline structure. Prep. 2-43; 3 Class Hrs.; 3 Lab. Hrs.; 4 Credit Hrs.

2-46 *Metal Processing* — Methods of processing metals in industry, including a study of small tool characteristics, machine tools, metal working costs, most effective methods for the removal of metal, the heat treatment of tools, the use of jigs and fixtures in the operation of modern manufacturing processes as well as actual operations and demonstrations of representative machine tools as lathes, milling machines, grinders, shapers, planers, and gear cutters. Prep. 2-43; 4 Class Hrs.; 6 Lab. Hrs.; 3 Credit Hrs.

2-60 *Mechanical Engineering Laboratory* — A preliminary laboratory course to familiarize the student with methods available for the measurement of standard characteristics, such as pressure, speed, temperature, flow rates, heats of combustion, thickness, and other linear dimensions, friction factors, heat transfer coefficients; gauge calibration, valve and controls setting, and strain gauging. Prep. 1-20, 2-23, 2-82, 2-83; 3 Lab. Hrs.; 2 Credit Hrs.

2-61 *Mechanical Engineering Laboratory* — This laboratory course and those following are designed to enable the student to conduct tests on power plant equipment in accordance with accepted standards, such as the ASME Power

Test Codes or the ASTM Standards, and to write and to submit adequate engineering reports. Tests are conducted on typical steam engines, pumping machinery, air compressors and blowers, and gasoline engines. Prep. 2-60, 2-84; 3 Lab. Hrs.; 2 Credit Hrs.

2-62 Mechanical Engineering Laboratory — Tests are conducted on typical air-conditioning units; refrigeration machines of the vapor compression type; Diesel engines; material tests of tension, torsion, and impact resistance of metals; and fluid mechanics. Prep. 2-24, 2-28, 2-60, 2-84, 2-85; 4 Lab. Hrs.; 3 Credit Hrs.

2-63 Mechanical Engineering Laboratory — Tests are conducted on transverse bending of steel beam; compression of metal and timber; lubricating oils; CFR test engine; vibrations; and fluid mechanics. Prep. 2-26, 2-62; 4 Lab. Hrs.; 3 Credit Hrs.

2-64 Testing Materials Laboratory — A detailed study is made of standard methods of inspecting and testing metals and woods of importance in structural engineering; tests are made to determine tensile properties, hardness, transverse strength, torsional resistance, column action, impact resistance, and bending properties; non-standard tests are included to demonstrate research methods applied to specific questions. Prep. 2-23, 2-43; 1 Class Hr.; 4 Lab Hrs.; 3 Credit Hrs.

2-67 Mechanical Engineering Laboratory — A short course in mechanical laboratory tests to meet the special needs of the students in Industrial Engineering with emphasis on materials testing. Prep. 2-23, 2-43, 2-82; 4 Lab. Hrs.; 3 Credit Hrs.

2-80 Heat Engineering — An introduction to the principles of thermodynamics; including the first and second laws, perfect gases, vapor tables, and simple thermodynamic processes; a study of the various types of equipment used in modern power plants such as boilers, engines, etc. Prep. 14-06, 15-06; 4 Class Hrs.; 4 Credit Hrs.

2-81 Heat Engineering (Thermodynamics) — The fundamentals of thermodynamics; including the general theory of heat and matter, the first and second laws of thermodynamics, availability of energy, entropy, equations of state of fluids, laws of perfect gases, specific heats, properties of liquids and vapors with the development and use of vapor tables and charts, thermodynamic processes of materials and the general equations of thermodynamics. Prep. 14-06, 15-06; 4 Class Hrs.; 4 Credit Hrs.

2-82 Heat Engineering — This is the first of a series of courses in which the principles of thermodynamics are applied to the various phases of heat engineering. The theory of vapor engines is thoroughly treated with emphasis on the simple Rankine, reheat, regenerative, and binary vapor cycles; an analysis of the types of actual engines used with their controlling devices and their operating characteristics, efficiencies, and capacity measures. Steam boilers, feed water heaters, and other power plant auxiliaries are considered from the equipment and performance viewpoints; treatment is also made of the theory of gas and vapor flow through orifices and nozzles. Prep. 2-81; 3 Class Hrs.; 3 Credit Hrs.

2-83 *Heat Engineering (Heat Transfer, Air Conditioning)* — An introduction to the principles of heat transfer; mean temperature differences, composite walls, conductivities, over-all heat transfer coefficients, convection, radiation. The principles of heating, ventilation, and air conditioning of buildings including studies of warm-air, steam, and hot-water systems; heating boilers; stokers and burners, combustion, and automatic controls. Prep. 2-81; 6 Class Hrs.; 3 Credit Hrs.

2-84 *Heat Engineering (Refrigeration, Compressors)* — A detailed study of the vapor compression system of refrigeration, evaporator and condenser design, low temperature refrigeration cycles both multi-stage and cascade types, multiple evaporator and compressor combinations, dual compression, absorption refrigeration and controls. General principles of gas compression and the application to the air compressor and to the air refrigeration cycle. Prep. 2-82; 4 Class Hrs.; 4 Credit Hrs.

2-85 *Heat Engineering (Internal Combustion Engines)* — A study of the internal combustion engine including an analysis of gasoline and Diesel engine construction, cycles, combustion theory, air-fuel mixtures, carburetion, detonation, valve timing, and fuels; and the effect of these items on the power output, efficiency, and design. Consideration is given to the data compiled from various research sources as well as to the theoretical aspects. Prep. 2-82; 4 Class Hrs.; 4 Credit Hrs.

2-86 *Heat Engineering (Turbines)* — A study of the various types of steam turbines, the dynamic action of jets on moving blades, and velocity diagrams; calculations of turbine efficiencies including the influence of friction; a study of the turbine losses; lubrication; governing mechanisms, and other constructional details; problems in the design of a turbine and the principles, performance, and constructional details of gas turbines. Prep. 2-82; 4 Class Hrs.; 4 Credit Hrs.

2-87 *Power Plant Engineering* — Topics and problems taken from engineering practice are discussed to give the student an understanding of the principles and methods of analyzing power plant problems, efficiencies, and costs of operation of different types of plants such as steam, hydro-electric, and Diesel to determine the type best suited for the conditions and location involved. Prep. 2-85, 2-86; 4 Class Hrs.; 4 Credit Hrs.

Electrical Engineering

3-01 *Electrical Engineering* — This course covers the basic principles of d-c and a-c circuits. Along with 3-02 and 3-03, it constitutes a three-course series designed to meet the needs of the non-electrical engineering student. Topics covered include d-c circuit theory, complex notation, real and reactive power, power factor, resonance phenomena, and three-phase circuits. Prep. 15-03, 15-04; 3 Class Hrs.; 3 Credit Hrs.

3-02 *Electrical Engineering* — This course continues the study begun in 3-01, and covers magnetic circuits, transformers, polyphase induction motors, synchronous machines, d-c machines, small motors, and special machines. Some

time is devoted to the discussion of applications of these devices in industry. Prep. 3-01; 3 Class Hrs.; 3 Credit Hrs.

3-03 *Electrical Engineering* — Emphasis in this course is placed on the application of electron tubes, motors, and related devices to industrial control problems. Topics treated specifically are high-vacuum tubes, thyratrons, phototubes, amplifiers, instrumentation, and electrical control. Prep. 3-02; 3 Class Hrs.; 3 Credit Hrs.

3-04 *Electrical Engineering* — This course is designed to meet the needs of the chemical engineering student in the application of electrical engineering to industrial processes. Basic d-c and a-c circuit theory is studied, as well as the elementary theory of electron tubes. Included in this is a study of the characteristics and associated circuits of the high-vacuum diode and triode, the thyatron, and the phototube.

A set of laboratory exercises accompanies the lecture course, and the experiments include work on d-c and a-c circuits, resonant conditions, diode and triode characteristics, rectification and filtering, voltage amplifiers, transient phenomena, and the characteristics and use of the phototube and the thyatron. Prep. 15-03, 15-04; 3 Class Hrs.; 3 Lab. Hrs.; 4 Credit Hrs.

3-05 *Electrical Engineering* — This course is a continuation of 3-04 and develops the application to industrial processes of those devices studied in the previous course. Included also are the operating characteristics of d-c motors and generators, a-c motors, transformers, as well as the control and regulation of motor speed and generator voltage, and the basic theory of feedback as applied to industrial processes. Laboratory demonstration periods accompany the lectures. Prep. 3-04; 3 Class Hrs.; 3 Credit Hrs.

3-15 *Polyphase A-C Circuits* — This course deals with polyphase circuits. Voltage, current, and power relations in polyphase circuits are studied in detail with emphasis on three-phase circuits. Both balanced and unbalanced conditions are considered. Particular attention is given to the methods of measuring three-phase power, and to the application of symmetrical phase components to the solution of unbalanced polyphase circuits. Prep. 3-53; 3 Class Hrs.; 3 Credit Hrs.

3-19 *Electromagnetic Field Theory* — This course is designed to equip the student with a working knowledge of electromagnetic theory. It covers four principal topics: electrostatics, magnetostatics, vector analysis, and Maxwell's equations. Included under these general headings are such items as Gauss' law, the law of Biot and Savart, and the equation of continuity. Much use is made of vector analysis which is essential for obtaining the solutions of practical problems. Prep. 14-20; 3 Class Hrs.; 3 Credit Hrs.

3-28 *Transmission Lines* — This course deals with the fundamental principles and applications of the transmission lines, throughout the entire range of frequencies, to the point where circuit theory must be replaced by field theory.

The traveling wave phenomenon is discussed first to distinguish the transmission line from the lumped circuits. This is followed by the consideration of the steady state solutions in various forms. Under lines with no reflection, the concepts of characteristic impedance and propagation function are introduced. Under lines with reflections, the important phenomenon of standing waves and their elimination are discussed. Both rectangular and circular trans-

mission line charts are used to solve problems of lossy and lossless lines. Special considerations are given to radio-frequency, telephone and telegraph, and power-transmission lines. Prep. 3-29; 4 Class Hrs.; 4 Credit Hrs.

3-29 *Advanced Field Theory* — This course is a continuation of 3-19 Electro-magnetic Field Theory. Maxwell's equations are applied to wave propagation, reflection, radiation, wave guides, and antennas. Prep. 3-19; 3 Class Hrs.; 3 Credit Hrs.

3-32 *Networks and Filters* — This course is a continuation of 3-28, beginning with a review of network analysis and characteristics of passive four-terminal networks. The ladder filters are discussed in detail, including constant-K and M-derived types. A very brief introduction of modern network synthesis will be given, using the stagger-tuned amplifiers as an example. Prep. 3-28; 3 Class Hrs.; 3 Credit Hrs.

3-51 *Electrical Engineering I* — An introductory course to electric-circuit theory covering Kirchhoff's laws, networks, solutions by the loop and nodal methods. The general problem of the solution of linear simultaneous equations as applied to resistance methods is thoroughly discussed, as well as such useful theorems as Thévenin's, Norton's, and reciprocity. Discussion of typical networks. Prep. 15-03, 15-04; 3 Class Hrs.; 3 Credit Hrs.

3-52 *Electrical Engineering II* — A study of transient phenomena of the first and second order for the various combinations of resistance, inductance, and capacitance. Singularity functions and impulse response. Complex representation of sinusoids. Prep. 3-51; 3 Class Hrs.; 3 Credit Hrs.

3-53 *Electrical Engineering III* — This is a continuation of 3-52. The behavior of circuits when excited in the sinusoidal steady state is studied. Impedance as viewed in the frequency domain, with treatment of such items as resonance, magnitude and frequency scaling, vector diagrams, and mutual inductance. Energy and power, both active and reactive, are also thoroughly covered. Prep. 3-52; 6 Class Hrs.; 3 Credit Hrs.

3-54 *Electrical Engineering IV* — Principles of magnetic circuits with d-c and/or a-c excitation. Permanent magnets. Air-core transformers and magnetic coupling. Single-phase power-transformer theory and application. Audio transformers. Prep. 3-53; 4 Class Hrs.; 3 Credit Hrs.

3-55 *Electrical Machinery I* — Introduction to a unified theory of electrical machinery wherein the rotating machine is regarded as a general electromechanical energy-conversion device. D-c machines; the analysis of their performance, control, and application aspects. Prep. 3-54, 3-15; 3 Class Hrs.; 3 Credit Hrs.

3-56 *Electrical Machinery II* — This course is a continuation of 3-55. It deals with the construction, general theory, and operating characteristics of synchronous generators and synchronous motors, and their applications. Prep. 3-55; 3 Class Hrs.; 3 Credit Hrs.

3-57 *Electrical Machinery III* — The material of 3-55 and 3-56 is extended to include polyphase induction motors, fractional-horsepower a-c motors, and special purpose machines such as the amplidyne and rototrol. Prep. 3-56; 3 Class Hrs.; 3 Credit Hrs.

3-60 Servomechanisms — An introductory treatment covering the analysis and design of simple servomechanisms through the use of the Laplace transform. Topics considered include system adjustments, compensation methods, and optimum design techniques. Typical automatic-control devices are discussed and some are demonstrated. Prep. 3-80; 3 Class Hrs.; 3 Credit Hrs.

3-70 Electronics I — This course introduces electron tubes and transistors. It is concerned with the motion of electrons in electric and magnetic fields, the elements of solid-state physics, the static and dynamic characteristic curves for vacuum tubes and transistors, the graphical location of operating points, and the incremental-parameter equivalent circuits. The object of the course is to give the student a thorough understanding of the physical operation of vacuum tubes and transistors and to demonstrate the basic techniques used for solving electronic-circuit problems. Prep. 3-53; 3 Class Hrs.; 3 Credit Hrs.

3-71 Electronics II — This course is a detailed study of the design, calculation, and operation of the basic vacuum-tube and transistor circuits. Grounded cathode, grounded-plate, and grounded-grid vacuum-tube circuits are considered along with their counterparts, grounded-emitter, grounded-collector, and grounded-base transistor circuits. Direct-coupled, R-C coupled, and transformer-coupled stages are examined in detail. Problems are solved involving practical circuits and the student acquires practice in both equivalent circuits and graphical methods of solution. Prep. 3-70; 3 Class Hrs.; 3 Credit Hrs.

3-72 Electronics III — This course includes a discussion of video amplifiers, r-f tuned amplifiers, and feedback amplifiers. The compensation of vacuum-tube and transistor amplifiers for shunt capacitance, coupling capacitance, and temperature effects is covered in detail. Vacuum-tube and transistor tuned amplifiers are considered (both narrow band and stagger tuned). Feedback amplifiers are discussed in terms of Bode's general formulas. The object of the course is to acquaint the student with the limitations and ultimate capabilities of electronic circuits. Prep. 3-71; 3 Class Hrs.; 3 Credit Hrs.

3-73 Electronics IV — The first part of this course will deal with vacuum-tube oscillators and will include criterion for oscillation, various types of oscillators, and frequency stabilization. The latter part of this course deals with broadcast receivers and includes the theory of amplitude and frequency modulation, and detection. Prep. 3-72; 3 Class Hrs.; 3 Credit Hrs.

3-74 Electronics V — This course will cover the pulse circuits commonly used in television, radar, pulse-modulated communication systems, and digital computers. Prep. 3-73; 3 Class Hrs.; 3 Credit Hrs.

3-80 Transients in Electric Circuits — The theory of the Laplace transform is developed from fundamental concepts, and the principles so established are applied in the solution of some typical lumped-parameter electric-circuit problems. Supporting topics covered include partial-fraction expansions, solutions to higher-order algebraic equations, singularity functions, and convolution methods. Prep. 3-53, 14-20; 6 Class Hrs.; 3 Credit Hrs.

3-90 *Electrical Engineering Laboratory I* — Included are experiments on series and parallel a-c circuits, instrument calibration, resistance measurements, network theorems, and transformer testing. Prep. 3-54; 2 Class Hrs.; 6 Lab. Hrs.; 3 Credit Hrs.

3-91 and 3-92 *Electrical Engineering Laboratories II and III* — These courses include experiments in the general areas of electrical measurements and basic electronic circuits. Nine experiments drawn from these areas are performed in Term 11, and nine additional ones are performed in Term 12. Prep. 3-70; 1 Class Hr.; 3 Lab. Hrs.; 3 Credit Hrs. per term.

3-93 *Electrical Engineering Laboratory IV* — This course includes experiments in the general areas of three-phase circuits, magnetic devices, and control engineering. Prep. 3-15, 3-54; 1 Class Hr.; 3 Lab. Hrs.; 3 Credit Hrs.

3-94 *Electrical Engineering Laboratory V* — The experiments in this course are about equally divided between the fields of power and communications. Power topics covered include the basic principles of operation of some energy-conversion devices, such as d-c motors and generators, elementary a-c machines, etc. In the area of communications, coverage is given to microwave circuits and devices, pulse circuits, frequency modulation, analog and digital computers, etc. Prep. 3-55, 3-29, 3-72; 4 Class Hrs.; 12 Lab. Hrs.; 6 Credit Hrs.

3-95 *Electrical Engineering Laboratory VI* — This course is primarily designed to show the application of electronic control and regulatory circuits (including servomechanisms). Minor attention is given to pulse-forming and delay lines, and to slotted lines for u-h-f impedance measurements. Prep. 3-29, 3-55; 2 Class Hrs.; 3 Lab. Hrs.; 4 Credit Hrs.

3-96 *Electrical Engineering Laboratory VII* — Included in this course are experiments on synchronous generators and motors, and induction motors. Prep. 3-56; 1 Class Hr.; 3 Lab. Hrs.; 3 Credit Hrs.

Chemical Engineering

4-42 *Properties of Materials* — Consideration of some of the modern theories of solid state physics, emphasizing the molecular concepts on which the physical properties of engineering materials depend. Prep. 11-65, 15-41; 2 Class Hrs.; 2 Credit Hrs.

4-43 *Engineering Materials* — A study of the various materials which are encountered in the chemical engineering profession. The effect of composition, heat treatment, and mechanical work upon the physical properties of metals and their alloys is emphasized. Other materials are studied in a similar manner. Prep. 11-04, 15-41, 4-42; 3 Class Hrs.; 3 Credit Hrs.

4-44 *Industrial Processes* — The major chemical process industries will be studied with emphasis on the kinetic and thermodynamic principles involved in the design and operation of the plant. Comprehensive problems will be assigned. Prep. 4-62, 4-63; 3 Class Hrs.; 3 Credit Hrs.

4-46 *Introduction to Nuclear Engineering* — Brief review of nuclear physics followed by a consideration of nuclear fission, the nuclear chain reactor, reactor theory, radiation shielding, materials of construction, reactor instrumentation and control, the separation of stable isotopes, chemical separations and processing, and special techniques of nuclear engineering. Prep. 15-41; 14-06; 4 Class Hrs.; 4 Credit Hrs.

4-50 *Introduction to Chemical Engineering* -- The primary purpose of this course is to present to the student a broad perspective of the fundamentals of the chemical engineering profession. The humanistic side as well as the scientific side of the profession is considered. Mathematical tools and stoichiometric relations are introduced and emphasized through problems. Prep. 11-02, 15-02; 4 Class Hrs.; 2 Credit Hrs.

4-51 *Chemical Engineering Literature* -- The course introduces the student to sources of information available to chemical engineers through a series of literature search problems. Prep. 4-50; 1 Class Hr.; 1 Credit Hr.

4-52 *Chemical Engineering Calculations* -- A study of such chemical engineering fundamentals as: material balance, energy balance, static equilibria, dynamic equilibria, and economic balance. This is essentially a problem course. Prep. 4-50; 4 Class Hrs.; 4 Credit Hrs.

4-60 *Fluid Mechanics* -- Development of the fundamental principles of fluid mechanics. A study of the methods of determining rates of flow and power consumption of fluids flowing through pipe lines. This course differs from the usual course in hydraulics chiefly in the amount of emphasis placed on the flow of gases and oils. Laboratory work is included. Prep. 15-02, 4-50; 5 Class Hrs.; 3 Lab. Hrs.; 3 Credit Hrs.

4-61 *Chemical Engineering Thermodynamics* -- The first law is developed for batch and flow systems. Heat effects in physical and chemical processes are discussed. Equations are derived relating the thermodynamic functions of fluids to variables of state. The second law, and preparation of tables and charts of thermodynamic properties from equations, is considered. Prep. 4-52, 14-07; 3 Class Hrs.; 3 Credit Hrs.

4-62 *Chemical Engineering Thermodynamics* --- Charts and tables of thermodynamic properties of substances are used to analyze and solve process problems. Physical and chemical equilibria are stressed. Applications of the first and second laws, particularly those involving compression and expansion of fluids, are considered. Prep. 4-61; 4 Class Hrs.; 4 Credit Hrs.

4-63 *Chemical Engineering Kinetics* -- Distinctions between rates and equilibria, units of reaction rates, the reaction velocity constant, and methods of determining reaction orders are treated. The chemical engineering principles of reactor design are developed and applied to homogeneous batch and flow reactions. Catalysis theory, transfer of heat and mass in catalytic beds, catalytic reactor design, and uncatalyzed heterogeneous reactions are considered. Prep. 4-62; 4 Class Hrs.; 4 Credit Hrs.

4-70 *Heat Transfer* -- A study is made of the basic concepts of heat transfer by conduction, convection, and radiation. Resistance to heat transfer of fluid films is stressed. Laboratory experiments are performed to illustrate the basic principles of heat transfer. Prep. 4-60, 4-52; 5 Class Hrs.; 3 Lab. Hrs.; 3 Credit Hrs.

4-71 *Chemical Engineering* -- A study of the application of chemical engineering fundamentals to mechanical separations, evaporation, air conditioning, and drying. Laboratory experiments are performed to illustrate fundamental principles. Students take an active part in planning the mode of operation of the equipment and the data to be taken. Report writing is stressed. Prep. 4-60, 4-52, 4-70; 4 Class Hrs.; 4 Lab. Hrs.; 6 Credit Hrs.

4-72 *Chemical Engineering* — A study of mass transfer techniques stressing the physical mechanisms involved in the transfer of material between homogeneous phases. Specific topics studied include absorption, distillation, and extraction. Laboratory work is included. Prep. 4-71; 4 Class Hrs.; 4 Lab. Hrs.; 6 Credit Hrs.

4-80 *Process Engineering Economics* — The fundamentals of economics and statistics previously acquired by the student are specifically applied to research, raw materials, markets, labor, power, water, transportation, labor relations, and similar economic factors as related to the process industries. Laws relating to waste disposal, atmospheric and stream pollution, and patents are discussed. Prep. 4-51, 20-12; 6 Class Hrs.; 3 Credit Hrs.

4-82 *Chemical Plant Costs* — Students estimate the capital required and the operating cost for a plant to produce a specified annual tonnage of one or more chemical materials. Equipment necessary to carry out the processes is selected and buildings required to house the plant are determined. Sources of cost data available without inquiry to manufacturers are searched out and drawn upon fully in making the estimates. Each student submits a report of his evaluation of the venture based upon these data and sound economic principles. Prep. 4-51, 4-80; 3 Class Hrs.; 3 Credit Hrs.

4-91 *Process Design* — Principles of process design engineering will be taught using as a basis the fundamentals of engineering science and economics studied in previous courses. The preparation of process flow sheets, complete material and energy balances, the selection of equipment, and the actual design of small chemical processing units will be assigned to the student. Prep. 4-71, 4-72; 1 Class Hr.; 6 Lab. Hrs.; 6 Credit Hrs.

4-92 *Process Design* — A continuation of 4-91 in which the scope will be extended to the actual process design of a complete chemical plant and the evaluation of the economic factors involved. Prep. 4-91; 6 Lab. Hrs.; 5 Credit Hrs.

4-93 *Projects* — Individual research related to some phase of chemical engineering. Open only to those students selected by the department head on the basis of scholarship and proved ability. Research topic will be selected by mutual agreement of the student and his supervising professor. Prep. 4-71, 4-72; 1 Class Hr.; 6 Lab. Hrs.; 6 Credit Hrs.

4-94 *Projects* — A continuation of the research work undertaken in 4-93. Prep. 4-93; 6 Lab. Hrs.; 5 Credit Hrs.

Industrial Engineering

5-09 *Industrial Statistics II* — A continuation of 20-22, this course examines further the drawing of inferences from samples, takes up simple linear correlation and fundamentals of statistical quality control. Prep. 20-22; 4 Class Hrs.; 3 Credit Hrs.

5-10 *Industrial Management* — The administrative and managerial aspects of plant operation are given thorough treatment in this course. Due consideration is given to such topics as: background and evolution of modern industrial man-

agement; ownership of industry; plant location and buildings; factory layout and equipment; the purchasing function; production planning and control. The course is designed to bring to the student an understanding of the problems facing management today. 3 Class Hrs.; 3 Credit Hrs.

5-11 Industrial Management — A continuation of 5-10, including such topics as: inspection and quality control functions; motion and time study; classification systems; cost accounting; maintenance; wage and salary administration; industrial safety. Prep. 5-10; 3 Class Hrs.; 3 Credit Hrs.

5-12 Methods Time Analysis — This course presents in detail the functions of the factory staff department commonly known as the Methods Department. These include process analysis through the use of process charts and flow diagrams; the operation analysis through the use of operation charts, man-and-machine charts, and micromotion study; the application of the principles of motion economy to all phases of factory operation, clerical and mechanical.

Complete laboratory facilities provide opportunity for the student to apply the subject matter of the course to a typical factory operation set up for this purpose. Prep. 5-11; 3 Class Hrs.; 3 Lab. Hrs.; 4 Credit Hrs.

5-13 Methods Time Analysis — The student is thoroughly trained in time study techniques and procedures; the use of the stop watch and other timing devices; performance rating; the application of allowances for unavoidable lost time and the computation of a fair work standard. The student is also taught the technique of setting standards by means of predetermined time systems. Prep. 5-12; 3 Class Hrs.; 3 Lab. Hrs.; 4 Credit Hrs.

5-14 Methods Engineering — This course is designed for students in Mechanical Engineering to show the proper use of work simplification and time study. The student is instructed in the use of process analysis, operation analysis, man-machine analysis, and micromotion analysis. This is accomplished through lectures, discussions, and actual laboratory projects.

Time study is discussed and the student is instructed in its correct use and how this tool can be used as an aid to management. Prep. 5-10; 1 Class Hr.; 2 Lab. Hrs.; 2 Credit Hrs.

5-17 Production Planning and Control — This course deals with the highly important "operating management" activity of planning and controlling the flow of materials through the shop, and the utilization of the equipment and manpower to best advantage.

Essential to this is a thorough knowledge of: factory organization, factory planning, nomenclature, stores keeping control, development and engineering, planning procedure, scheduling, routing, dispatching, the use of special control charts and boards, forecasting, and budgeting. Actual case problems are analyzed by the students. Prep. 5-11; 3 Class Hrs.; 3 Credit Hrs.

5-18 Quality Control — The materials presented in this course are designed to give the student a knowledge of the problems involved in setting up a Quality Control department within the factory. The subject matter includes fundamentals of statistical quality control, theory and application of various types of control charts, probability theory, sampling methods, and the statistics of reliability. Prep. 5-09; 3 Class Hrs.; 2 Lab. Hrs.; 3 Credit Hrs.

5-19 *Personnel Administration* — The purpose of this course is to survey the personnel function as an element of management. This course deals with the humanistic side of personnel relations as opposed to the technical aspects. Emphasis is placed on the development of a sound philosophy of employer-employee relations. 3 Class Hrs.; 3 Credit Hrs.

5-20 *Job Evaluation and Wage Incentives* — A study of job evaluation techniques and the problems of installing and maintaining job and position evaluation systems and wage incentives in industrial enterprises. Prep. 5-11; 3 Class Hrs.; 3 Credit Hrs.

5-22 *Process Planning and Tool Design* — The principles and procedures of planning productive processes to manufacture articles at lowest cost consistent with volume; operation analysis; tool layout; design of jigs, fixtures, and other special tools; use of synthetic time standards in tool design. Prep. 2-43; 5-11; 5 Class Hrs.; 5 Lab. Hrs.; 3 Credit Hrs.

5-23 *Plant Layout and Material Handling* — The design of an industrial plant from consideration of geographical location through collection and analysis of necessary data to formulate processing, selection of equipment, and arrangement of production and service facilities for economy of manufacture with full regard to material handling problems, safety and working conditions. An actual plant layout is carried through in the laboratory. Prep. 5-11, 5-22; 3 Class Hrs.; 6 Lab. Hrs.; 5 Credit Hrs.

5-25 *Engineering Economy* — The use of economic analysis in formulating business policies with particular emphasis on engineering aspects; criteria and technique of engineering economy as related to cost, economy of design, economy of selection, and application of engineering projects. Prep. 5-13, 5-18, 5-20; 4 Class Hrs.; 4 Credit Hrs.

5-26 *Seminar* — Summation and correlation of prior work with particular emphasis on its relation to the over-all management problem and the health of the enterprise; selected topics from the current problems and literature in industrial engineering. Prep. Senior standing in industrial engineering; 2 Class Hrs.; 2 Credit Hrs.

Biology

10-01 *General Biology* — This course is designed to give the student an acquaintance with the fundamental principles of, and an introduction to, the various fields of biology beginning with the physical, chemical, and biological characteristics and behavior of protoplasm and cells; general plant and animal histology; irritability and conduction. The laboratory periods parallel the lecture materials. 2 Class Hrs.; 3 Lab. Hrs.; 3 Credit Hrs.

10-02 *General Biology* — Plant and animal metabolism; maintenance of the internal environment; gametogenesis and cell division. Laboratory work begins a survey of the plant and animal kingdoms. Prep. 10-01; 2 Class Hrs.; 3 Lab. Hrs.; 3 Credit Hrs.

10-03 *General Biology* — Principles of genetics and eugenics; basic patterns of embryology; plant life histories. Laboratory work is devoted to a study of amphibian morphology with general comparisons to man. Prep. 10-02; 2 Class Hrs.; 3 Lab. Hrs.; 3 Credit Hrs.

10-04 *General Biology* — Life histories of animals; organic evolution; bioecology. Laboratory parallels lectures. Prep. 10-03; 3 Class Hrs.; 3 Lab. Hrs.; 2 Credit Hrs.

10-09 *Evolution* — A consideration of the theories of the origin of life and its diversity. Early concepts are discussed together with Darwinism and Neo-Darwinism. Emphasis is placed upon the importance of homology, taxonomy, paleobiology, embryology, morphology, and genetics as supportive evidence for organic change. 5 Class Hrs.; 2½ Credit Hrs.

10-15 *Conservation* — A consideration of the basic biological relationships existing between man and his living and non-living environments, with an evaluation of land-use practices and various methods employed in the conservation of biological resources. 5 Class Hrs.; 2½ Credit Hrs.

10-20 *General Bacteriology* — The biology of microorganisms, emphasizing the bacteria. The course deals with the preparation of media, the methods of sterilization, staining, isolation, and identification of pure cultures together with studies on the biochemical activities and effects of physical agents. The laboratory studies are correlated closely with lecture topics and serve to develop in the student the proper technique of handling, observing, and working with non-pathogenic microorganisms. Prep. 10-04; 3 Class Hrs.; 3 Lab. Hrs.; 4 Credit Hrs.

10-21 *General Bacteriology* — An introduction to the bacteriology of water, sewage, air, and milk. The course includes a consideration of standards, plate counts, and physiological tests for water and milk; a bacterial analysis of air and the treatment and proper disposal of sewage. The laboratory illustrates the types, names, chemical reactions, and prevalence of organisms associated with each aspect of the course as revealed from actual samples collected by the student. Prep. 10-20; 3 Class Hrs.; 3 Lab. Hrs.; 4 Credit Hrs.

10-40 *Physiology* — A course in human physiology including the study of protoplasm and life processes, enzymes, tissues, translocation, and utilization of materials; control of tissue activity; the study of the circulatory, respiratory, excretory, and digestive systems; protein, carbohydrate, and fat metabolism. The laboratory work consists of blood counts, hemoglobin determination, tests for blood, hemolysis, urinalysis; general and specific tests for proteins, carbohydrates, and fats. Prep. 10-04; 3 Class Hrs.; 3 Lab. Hrs.; 4 Credit Hrs.

10-41 *Physiology* — A course in muscle-nerve physiology, physiological properties of nerves, neuro-anatomy of the spinal cord and brain, the physiology of the central and peripheral nervous system, autonomic nervous system; the special senses organs; endocrine and reproductive systems. The laboratory consists of practice of the use of apparatus, with experiments on muscle-nerve stimulation and the special senses. Prep. 10-40; 3 Class Hrs.; 3 Lab. Hrs.; 4 Credit Hrs.

10-55 *Comparative Vertebrate Anatomy* — The development and significance of the structural and physiological changes in the chordate groups; homology, analogy, metamerism, cephalization; general features of embryological development of the chordates, the basic principles of phylogenesis, the geological time scale provide a broad background for the interpretation of the significant morphological changes occurring in the exoskeleton, endoskeleton, and muscle systems. Prep. 10-02; 3 Class Hrs.; 3 Lab. Hrs.; 4 Credit Hrs.

10-56 *Comparative Vertebrate Anatomy* — Continued discussions of the comparative anatomy and general treatment of the embryological and phylogenetic development of the digestive, circulatory, respiratory, excretory, reproductive, and nervous systems, tracing the chief evolutionary and ontogenetic sequences of these systems in the main vertebrate classes. The laboratory work consists of a detailed dissection of the systems of the mammal. Prep. 10-55; 3 Class Hrs.; 3 Lab. Hrs.; 4 Credit Hrs.

10-57 *Invertebrate Zoology* — A study of the classification, structure, and life histories of various forms selected from the major divisions of the invertebrates. Prep. 10-04; 3 Class Hrs.; 3 Lab. Hrs.; 4 Credit Hrs.

10-58 *Invertebrate Zoology* — A continuation of 10-57. Prep. 10-57; 3 Class Hrs.; 3 Lab. Hrs.; 4 Credit Hrs.

10-59 *Animal Histology* — A study of the normal microscopic anatomy of the tissues and organ systems of the body, including studies of the microscopic anatomy of cells, cell division, cytomorphosis, and cell differentiation. A general survey of the characteristics of the main varieties of tissues and detailed studies of the morphology and function of epithelial, connective, and vascular tissues. The laboratory periods are used in the study of selected slides and a general introduction to the principles of microscopy. Prep. 10-56; 3 Class Hrs.; 3 Lab. Hrs.; 4 Credit Hrs.

10-60 *Animal Histology* — Further considerations of the microscopic anatomy of animals by a study of characteristics and functions of muscle and nervous tissues with the histology of the lymphatic, vascular, digestive, endocrine, reproductive, and sense organs. The laboratory work consists of continued studies of slides illustrating the cellular characteristics of organs and systems. Prep. 10-59; 3 Class Hrs.; 3 Lab. Hrs.; 4 Credit Hrs.

10-61 *Embryology* — The descriptive embryogeny of amphioxus and the morphological development of the organ systems in the chick, pig, and man, principles of embryonic development are discussed with topics on histogenesis, organogenesis, and the consideration of factors influencing development. A detailed study is made in the laboratory of organogenesis in the chick by means of serial sections, whole mounts, and models representing significant stages of early development. Prep. 10-56; 3 Class Hrs.; 3 Lab. Hrs.; 4 Credit Hrs.

10-62 *Embryology* — The development of man including the subjects of spermatogenesis and oögenesis; the endocrine factors influencing ovulation; the determination of sex; the period of the ovum, blastulation, and gastrulation; development and functional significance of the foetal membranes and circulation, and consideration of the embryology of the several systems of the body. The laboratory periods are devoted to a study of organogenesis in the pig with demonstrations of significant stages of human development. Prep. 10-61; 3 Class Hrs.; 3 Lab. Hrs.; 4 Credit Hrs.

10-65 *Genetics* — The study and discussion of variation, the laws of inheritance as found in animals and plants, and their application to human relations, including the observational, experimental, cytological, statistical, and developmental approaches. The laboratory includes methods of culturing, handling, and experimental crossing of *Drosophila*. Prep. Senior standing; 3 Class Hrs.; 3 Lab. Hrs.; 4 Credit Hrs.

10-66 *Genetics* — A detailed study of the gene and its physiological aspects in relation to development and behavior. The consideration of population genetics and evolution. The laboratory work includes an extension of the work on *Drosophila* and a statistical analysis of data. Prep. 10-65; 3 Class Hrs.; 3 Lab. Hrs.; 4 Credit Hrs.

10-69 *Histological Technique* — The fundamentals of histological technique, by laboratory means, introducing the student to the general methods of tissue preparation for purposes of microscopic study. The preparation of solutions and stains, the microtome and its operation together with specific directions for fixation, clearing, hardening, embedding, section-cutting, and staining of tissues. Prep. 10-56; 6 Lab. Hrs.; 2 Credit Hrs.

10-70 *Histological Technique* — Practical application of the basic principles of tissue preparation and sectioning with exercises on the preparation of several tissues of the animal body portraying the qualities of selected stains and their combinations. Prep. 10-69; 6 Lab. Hrs.; 2 Credit Hrs.

10-71 *History of Biology* — An historical survey of the development, trends, and theoretical principles of biological thought. The purpose is to present, as inclusively as possible, the progressive development of biology, emphasizing the specific contributions that have been made, beginning with the philosophers of Greece and Babylonia and Rome, continuing in sequence through the Middle Ages, the Renaissance, and the eighteenth, nineteenth, and twentieth centuries. 4 Class Hrs.; 4 Credit Hrs.

10-80, 10-81 *Senior Research* — Experimental work in biology under the direction of staff members. Approval of department head necessary. Each course carries 2 to 4 hours credit and extends through a single term.

10-82, 10-83 *Seminar (Biology)* — Discussion of the development, trends, and theoretical principles of biological thought. Approval of department head necessary. 2 Class Hrs.; 1 Credit Hr. (each term).

Chemistry

11-01 *General Chemistry* — Fundamental ideas of matter and energy, states of matter, changes of state, symbols, equations, chemistry of hydrogen, oxygen, water, and early ideas of atoms and molecules. Study of subatomic particles and periodic classification of elements. 3 Class Hrs.; 3 Lab. Hrs.; 4 Credit Hrs.

11-02 *General Chemistry* — Chemical equilibrium, solutions, redox reactions, ionic equilibrium, acids and bases, properties and reactions of halogens and sulfur. Prep. 11-01; 3 Class Hrs.; 3 Lab. Hrs.; 4 Credit Hrs.

11-03 *General Chemistry* — Chemistry of nitrogen, qualitative analysis of cations, electrochemistry, principles of metallurgy, properties and reactions of alkali metals, alkaline earth metals, and boron family. Prep. 11-02; 3 Class Hrs.; 3 Lab. Hrs.; 4 Credit Hrs.

11-04 *General Chemistry* — Study of chemistry of carbon and group properties of silicon, tin, and lead, terminology of organic chemistry, open-chain compounds and their derivatives, petroleum and its refining, closed-chain hydrocarbons and derivatives, elements of polymer chemistry including rubber substitutes and plastics. Prep. 11-03; 3 Class Hrs.; 3 Lab. Hrs.; 2 Credit Hrs.

11-05 *General Chemistry* — Chemistry of carbon, silicon, tin and lead. Principles of ionic reactions and ionic equilibrium. Redox reactions in aqueous solution. Prep. 11-03; 3 Class Hrs.; 3 Lab. Hrs.; 2 Credit Hrs.

11-17 *Quantitative Analysis* — Theory and practice of volumetric analysis, standardization, neutralization, redox titrations. Prep. 11-05; 3 Class Hrs.; 3 Lab. Hrs.; 4 Credit Hrs.

11-18 *Quantitative Analysis* — Elements of instrumental analysis. Theory and use of colorimeter, absorption instruments, pH measurements, and chromatography. Prep. 11-17; 2 Class Hrs.; 3 Lab. Hrs.; 3 Credit Hrs.

11-26 *Organic Chemistry* — The hydrocarbons, alcohols, and phenols. Molecular structure, nomenclature, properties, and reactions of aliphatic, alicyclic, and aromatic hydrocarbons. Synthesis and reactions of alcohols and phenols. Prep. 11-05; 3 Class Hrs.; 3 Lab. Hrs.; 4 Credit Hrs.

11-27 *Organic Chemistry* — Monofunctional compounds. Synthesis, properties, and reactions of halides, ethers, aldehydes, ketones, acids, ester, fats, amines, amides, nitriles, and azo compounds, with some attention to biological significance. Prep. 11-26; 3 Class Hrs.; 3 Lab. Hrs.; 4 Credit Hrs.

11-28 *Organic Chemistry* — Polyfunctional compounds. Substituted acids, quinones, dyes, stereoisomerism, amino acids, carbohydrates, and proteins, with special emphasis on biological significance. Prep. 11-37; 3 Class Hrs.; 6 Lab. Hrs.; 5 Credit Hrs.

11-41 *Chemical Literature* — Uses of abstracting journals, types and sources of publications, patents as sources of information, sources of financial, statistical, and industrial information. Preparation of a detailed bibliography on an original topic. Preparation of written progress reports, typical research reports, etc. Prep. 11-54; 3 Class Hrs.; 3 Credit Hrs.

11-43, 11-44 *Senior Research* — Experimental work under direction of staff members. Approval of department head necessary. Each course carries 3 credits and extends throughout a single term. 9 Lab. Hrs.; 3 Credit Hrs.

11-45 *Biological Chemistry* — The chemistry of metabolism. Electrolytic equilibrium, elementary reaction mechanisms, catalysis, oxidation-reduction. Enzymes. Metabolism of carbohydrates, proteins, fats, and nucleic acids. Prep. 11-53 or 11-28; 4 Class Hrs.; 4 Credit Hrs.

11-51 *Organic Chemistry* — Study of the more common functional groups in aliphatic compounds. Modern electronic theory is used to give the student a better understanding of the chemical behavior of molecules containing these functional groups. Family relationships, methods of preparation, nomenclature, and chemical behavior are stressed. The laboratory preparations are selected to illus-

trate the chemical behavior of the functional groups and also to teach the more common techniques used in the preparation of organic compounds. Prep. 11-05; 3 Class Hrs.; 6 Lab. Hrs.; 5 Credit Hrs.

11-52 *Organic Chemistry* — Chemistry of aromatic rings and their mutual effect on the common functional groups. Modern electronic theory is used to interpret the chemical behavior of these groups. Selected laboratory experiments illustrate the preparation and chemistry of the carbocyclic aromatic compounds. Prep. 11-51; 3 Class Hrs.; 6 Lab. Hrs.; 5 Credit Hrs.

11-53 *Organic Chemistry* — An advanced course designed to give the student a more thorough understanding of the fundamentals of organic chemistry. Special topics are selected to acquaint the student with the best sources of chemical information available. Some of the topics covered are: a detailed study of aromaticity, reaction mechanisms and catalysis, free radicals, alicyclic chemistry including spiro, dispiro, and bicyclo compounds, terpenes, steroids and the chemistry of five- and six-membered heterocyclic ring compounds. Prep. 11-52; 3 Class Hrs.; 3 Lab. Hrs.; 4 Credit Hrs.

11-54 *Organic Chemistry* — This course covers the same class material as 11-52 but does not include any laboratory. Prep. 11-51; 3 Class Hrs. 3 Credit Hrs.

11-56 *Organic Chemistry* — Topics included in this course are: carbohydrates, fats, proteins, dyes, synthetic resins, commercial solvents and other important industrial products such as petrochemicals. The most recent industrial methods are discussed to keep the student abreast with current literature in chemistry. Prep. 11-52 or 11-54; 3 Class Hrs.; 3 Credit Hrs.

11-57 *Qualitative Organic Analysis* — Qualitative analysis of organic compounds having one of two functional groups. Single liquids, single solids, liquid mixtures, solid mixtures, and some industrial products are analyzed by each student. Techniques are developed for making physical measurements, solubility tests, classification tests, literature surveys, and preparation of derivatives. Prep. 11-52; 9 Lab. Hrs.; 3 Credit Hrs.

11-58 *Organic Preparations* — Advanced organic preparations, based on recent literature, and selected to teach the laboratory techniques necessary for graduate school or industrial organic research. Prep. 11-52; 9 Lab. Hrs.; 3 Credit Hrs.

11-61 *Physical Chemistry* — The three states of matter: gases, liquids, solids. Solutions: solubility, boiling points, colligative properties. Prep. 11-52 or 11-54; 3 Class Hrs.; 3 Lab. Hrs.; 4 Credit Hrs.

11-62 *Physical Chemistry* — Colloidal dispersions. Physical properties and molecular constitution. Thermodynamics: the first law, thermochemistry, entropy. Prep. 11-61; 3 Class Hrs.; 3 Lab. Hrs.; 4 Credit Hrs.

11-63 *Physical Chemistry* — Continuation of thermodynamics: free energy, chemical equilibrium, phase diagrams. Chemical kinetics. Prep. 11-62; 3 Class Hrs.; 3 Lab. Hrs.; 4 Credit Hrs.

11-64 *Physical Chemistry* — Solutions of electrolytes: transference and conductance, theory of electrolytic solutions, ionic equilibria, electromotive force, electrolysis and polarization. Prep. 11-63; 3 Class Hrs.; 3 Lab. Hrs.; 4 Credit Hrs.

11-65 *Physical Chemistry* — This course covers the same class material as 11-63 but does not include laboratory. Prep. 11-62; 3 Class Hrs.; 3 Credit Hrs.

11-70 *Quantitative Analysis* — Theory and practice of gravimetric analysis. Analysis of certain inorganic elements in rocks and alloys. Use of electrolytic methods. Prep. 11-62; 5 Class Hrs.; 6 Lab. Hrs.; 3 Credit Hrs.

11-71 *Quantitative Analysis* — Theory and practice of volumetric analysis. Use of the analytical balance, calibration of glassware, acidimetry and alkalinity, neutralization and precipitation methods, and the use of indicators. Prep. 11-70; 3 Class Hrs.; 6 Lab. Hrs.; 5 Credit Hrs.

11-73 *Analytical Chemistry* — A brief course in the use of instrumental and physicochemical methods in analytical chemistry, including the types of instruments available, the theory of their operation. Prep. 11-62; 2 Class Hrs.; 3 Lab. Hrs.; 3 Credit Hrs.

11-76 *Instrumental Analysis* — A course in the use of instrumental and physicochemical methods in analytical chemistry, including the types of instruments available, the theory of their operation. Prep. 11-71; 3 Class Hrs.; 6 Lab. Hrs.; 5 Credit Hrs.

11-81 *Inorganic Chemistry* — Electronic structure, the periodic tables, nature of covalent and electrovalent bonds as illustrated by the chemistry of non-metals. Prep. 11-62; 3 Class Hrs.; 3 Credit Hrs.

11-82 *Inorganic Chemistry* — Electronic structure, the periodic table, and the nature of covalent and electrovalent bonds as illustrated by the chemistry and structure of metals. Prep. 11-81; 3 Class Hrs.; 3 Credit Hrs.

11-91 *Special Topics* — Discussion of advanced topics in organic chemistry. Topics vary from year to year. Prep. 11-54; 3 Class Hrs.; 3 Lab. Hrs.; 4 Credit Hrs.

11-92 *Special Topics* — Discussion of advanced topics in physical chemistry. Topics vary from year to year. Prep. 11-91; 3 Class Hrs.; 3 Credit Hrs.

11-93 *Nuclear Chemistry* — Radioactivity, nuclear reactions, atomic fission, properties of isotopes, use of radioactive tracers. Prep. 11-64; 3 Class Hrs.; 3 Credit Hrs.

Graphic Science

12-01 *Engineering Drawing* — A course in fundamentals of the graphic language as applied in engineering. It comprises a thorough study of multi-planar orthographic shape description as a foundation for the later study of working drawings. The work is laid out to include the following divisions: care and use of drawing equipment, freehand lettering, geometric constructions, elements of nomography, vector diagrams, multiview orthographic drawing, including primary and secondary auxiliary views, and freehand technical sketching. 6 Lab. Hrs.; 3 Credit Hrs.

12-02 *Engineering Drawing* — This is a continuation of Course 12-01 and includes a study of pictorial drawing, working drawings, and applications of

A.S.A. standards. Isometric, oblique, and parallel and angular perspective are studied in the pictorial field. Sections, dimensioning, screw threads, fasteners, and ink tracing are applied to simple detail and assembly drawings. Pencil work on vellum is made suitable for the various reproduction processes. Prep. 12-01; 6 Lab. Hrs.; 3 Credit Hrs.

12-03 *Descriptive Geometry* — This is a course in the theory of projection drawing. It is designed to develop powers of visualization and to solve, by revolution, auxiliary and direct method problems involving space relationships. In addition to problems with point, line, and plane, the course includes a study of intersection and development of surfaces, shadows, mining problems, graphic solutions of stresses in framed structures, and other problems of a practical nature. Prep. 12-01; 6 Lab. Hrs.; 3 Credit Hrs.

12-04 *Machine Drawing* — Detail working drawings of machine parts and assembly drawings of simple machines are made according to recommendations of the American Standards Association. Elements of fundamental design and such simple phases of mechanism as are essential to a complete understanding of machine drawing are included in the course. Fasteners, machine parts, and samples of small machines are made available for reference. Drawings are reproduced by students in blueprint, ozalid, blackline, and photograph. Prep. 12-01, 12-02; 6 Lab. Hrs.; 2 Credit Hrs.

12-05 *Graphic Representation* — A study of fundamentals of the graphic language intended to familiarize the student with the solution of problems involving scientific data using graphical methods. The course includes a study of the purpose and use of drafting equipment, geometric and projective constructions including the conics, lettering, scalars and vectors, graphical scales including simple nomography and charts, empirical and periodic curves, elements of orthographic and axonometric drawing, and inking as applied to presentation of data. 3 Class Hrs.; 6 Lab. Hrs.; 3 Credit Hrs.

Geology

13-04 *Historical Geology* — How and when did the earth begin and what changes have taken place since its beginning will be the major concern of this course. The various geologic periods will be discussed as to land form changes, the forces causing these changes, and the particular plants and animals common to each period. Emphasis will be placed on the geologic history of the eastern United States. 5 Class Hrs.; 2½ Credit Hrs.

13-05 *Physical Geology* — This course is concerned with the structure of the earth and those forces which are acting to shape the various topographical formations. After an introduction to rocks and minerals the geological principles of weathering, erosion, diastrophism, and volcanism will be discussed. 5 Class Hrs.; 2½ Credit Hrs.

Mathematics

14-05 *Differential Calculus* — This course continues from 14-54. Topics include differentiation of algebraic, trigonometric, exponential, and logarithmic func-

tions; successive, implicit, explicit, partial, total differentiation; curvature; points of inflection; related rates; velocity, acceleration; maxima and minima; indeterminate forms; infinite series; applications in geometry, physics, and mechanics. Prep. 14-54; 4 Class Hrs.; 4 Credit Hrs.

14-06 *Integral Calculus* — The course deals with integration as the inverse of differentiation as well as the limit of summation. Topics include methods of integration; successive, indefinite, definite integrals; constant of integration; rectangular and polar coordinates; areas, center of gravity; moment of inertia; length of arc; volumes; areas of surfaces of revolution; multiple integrals. Prep. 14-05; 4 Class Hrs.; 4 Credit Hrs.

14-07 *Differential Equations* — The elementary theory and solution of ordinary differential equations is offered as a general course in mathematics. Although principally a problem course, properties of equations and of their solutions are deduced and various applied problems are analyzed. Series solutions are obtained for some differential equations. Prep. 14-06; 4 Class Hrs.; 4 Credit Hrs.

14-08 *Differential Equations* — A second course which includes special cases of first order equations; first order higher degree with envelopes; special loci; particular curves; applications in mechanics; algebra of linear differential operators; general second order linear equations with some special methods; elementary partial differential equations of the first and second orders. Prep. 14-07; 4 Class Hrs.; 4 Credit Hrs.

14-11 *Theory of Equations* — A first course in theory and analysis of equations and polynomials; continuity; complex numbers in all forms; some theory of numbers; solution of equations of higher degree; discriminants; theorems on roots; proof of the fundamental theorem of algebra; some symmetric functions. Prep. 14-06; 5 Class Hrs.; 2½ Credit Hrs.

14-14 *History of Mathematics* — A survey of the development of the various branches of mathematics, with special attention to the lives of men who have made outstanding contributions to mathematical science; relations between the growth of mathematical knowledge and the development of civilization. Prep. 14-06; 5 Class Hrs.; 2½ Credit Hrs.

14-15 *Advanced Calculus* — This and the following course are essential to advanced study in both pure and applied mathematics. Some of the topics are theorems on limits and continuity; differentiability; mean-value theorems of both differential and integral calculus; Riemann definite integral; differentiation of integrals; Taylor's formula with remainder; indeterminate forms. Prep. 14-06; 4 Class Hrs.; 4 Credit Hrs.

14-16 *Advanced Calculus* — A continuation of 14-15. Topics include partial differentiation, especially for implicit and composite functions; extrema with constraints, and Lagrange's method and multipliers; Taylor's series for two variables; Jacobians; line integrals; transformation of multiple integrals; improper integrals, including the gamma function and Laplace transforms. Prep. 14-15; 4 Class Hrs.; 4 Credit Hrs.

14-17 *Infinite Series* — Study of limits; infinite series; tests of convergence and divergence; algebraic operations with series; integration and differentiation; integration by means of series; applications and uses of special series, including power and Fourier series; solution of differential equations by series including Legendre's and Bessel's equations. Prep. 14-07; 4 Class Hrs.; 4 Credit Hrs.

14-20 *Advanced Mathematics for Engineers* — Further study in differential equations; solution by infinite series; Fourier series; Gamma function; Bessel's and Legendre's equations; solution of partial differential equations by separation of variables, with initial and boundary conditions; Fourier-Bessel and Fourier-Legendre expansions; vector analysis. Prep. 14-07; 3 Class Hrs.; 3 Credit Hrs.

14-21 *Basic Mathematics I* — A course in algebra for Liberal Arts students, which stresses basic mathematical concepts as well as applications. Logical development of the real and complex number systems; solution of linear and quadratic equations and simultaneous equations; exponents, radicals, and logarithms. 3 Class Hrs.; 3 Credit Hrs.

14-22 *Basic Mathematics II* — A continuation of 14-21. The algebra of sets; permutations and combinations; fundamentals of plane trigonometry, including law of sines and law of cosines; elements of analytic geometry including equations of straight line and circle. Prep. 14-21; 3 Class Hrs.; 3 Credit Hrs.

14-23 *Basic Mathematics III* — A continuation of 14-22. Functions and their graphs; sequences and limits; introduction to differential and integral calculus with applications; fundamentals of probability and statistics. Prep. 14-22; 3 Class Hrs.; 3 Credit Hrs.

14-28 *Mathematical Statistics* — The elements of probability theory for discrete and continuous distributions; basic principles of statistical inference; classification of data; moments of empirical and theoretical distributions; moment-generating functions; binomial, Poisson, and normal distributions; random sampling; testing of hypotheses with large samples; empirical linear correlation and regression. Prep. 14-06; 4 Class Hrs.; 4 Credit Hrs.

14-29 *Mathematical Statistics* — A continuation of 14-28. The normal distribution for two variables as a model for correlation and regression; the chi-square distribution and its applications; confidence interval estimation; Student's t-distribution for small samples; Snedecor's F-distribution; brief introduction to analysis of variance, sampling inspection, sequential analysis, and non-parametric methods. Prep. 14-28; 4 Class Hrs.; 4 Credit Hrs.

14-30 *Determinants and Matrices* — This course is for Industrial Engineers. An introduction to logic, sets, probability theory, determinants, and matrices. Prep. 14-06; 5 Class Hrs.; 2½ Credit Hrs.

14-31 *Geometries* — A survey of the development of various systems of geometry from a common foundation, and a study of the geometry and calculus of three dimensions. The course emphasizes the role of the parallel postulate in the geometry of Euclid and in the non-Euclidean geometries of Bolyai, Lobachevsky, and Riemann. The space geometry covers cylindrical and spherical as well as rectangular coordinates, and analyzes planes, surfaces, and curves, finding tangent and normal planes and lines, and volume and surface integrals. Prep. 14-06; 4 Class Hrs.; 4 Credit Hrs.

14-33 *Vector Analysis* — Topics included are vector algebra, differentiation of vectors, integration of vectors, the del operator, line integrals, and an introduction to vector spaces. Prep. 14-06; 4 Class Hrs.; 4 Credit Hrs.

14-35 *Numerical Analysis* — Several methods are utilized for the approximate solution of algebraic, transcendental, and differential equations as well as definite integrals and the analysis of tabulated data. Prep. 14-07; 4 Class Hrs.; 4 Credit Hrs.

14-37 *Abstract Algebra I* — Study of algebraic systems; groups, integral domains, rings, and fields. Includes an axiomatic treatment of the real number system. Prep. 14-06; 4 Class Hrs.; 4 Credit Hrs.

14-38 *Abstract Algebra II* — A continuation of 14-37. Topics include: vector spaces, linear transformations, matrices, determinants, and systems of linear equations. Prep. 14-37; 4 Class Hrs.; 4 Credit Hrs.

14-41 *Fundamentals of Mathematics I* — An introductory course for Business Administration and Liberal Arts students, which stresses basic mathematical concepts as well as applications. Logical development of the real and complex number systems; solution of linear and quadratic equations and simultaneous equations; exponents, radicals, and logarithms; elements of analytic geometry, including equations of straight line and circle. 8 Class Hrs.; 4 Credit Hrs.

14-42 *Fundamentals of Mathematics II* — A continuation of 14-41. The algebra of sets; permutations and combinations; fundamentals of plane trigonometry, including law of sines and law of cosines; further topics in analytic geometry; functions and their graphs. Prep. 14-41; 5 Class Hrs.; 2½ Credit Hrs.

14-43 *Fundamentals of Mathematics III* — A continuation of 14-42. Sequences and limits; introduction to differential and integral calculus with applications; fundamentals of probability and statistics. Prep. 14-42; 5 Class Hrs.; 2½ Credit Hrs.

14-51 *Mathematics I* — A first course in college mathematics for Engineering students. Plane trigonometry through the solution of right triangles; introduction to analytic geometry; locus problems; equation of straight line and circle; review of related topics in algebra. Prep. 3½ units of college preparatory mathematics; 5 Class Hrs.; 4 Credit Hrs.

14-52 *Mathematics II* — A continuation of 14-51. Permutations and combinations; introduction to probability and statistics; determinants; further study of trigonometric functions and their inverse functions; compound angles; trigonometric identities and equations; complex numbers; continuation of analytic geometry with study of the conic sections. Prep. 14-51; 5 Class Hrs.; 4 Credit Hrs.

14-53 *Mathematics III* — A continuation of 14-52. Introduction to differential calculus; slope of secant and tangent lines; differential and derivative of algebraic functions; maximum and minimum values of functions with applications; additional topics in algebra; introduction to infinite series and vector algebra. Prep. 14-52; 5 Class Hrs.; 5 Credit Hrs.

14-54 *Mathematics IV* — A continuation of 14-53. Graphs of trigonometric, exponential, and logarithmic functions; polar coordinate curves. Continuation of differential calculus; differentiation of implicit functions, products, fractions,

trigonometric functions; successive derivatives with applications; introduction to integration. Prep. 14-53; 5 Class Hrs.; $2\frac{1}{2}$ Credit Hrs.

14-61 *Mathematical Analysis I*—A first course for Chemistry, Physics, and Mathematics majors. An introduction to analytic geometry and differential calculus. A review of related topics in algebra and trigonometry. Prep. $3\frac{1}{2}$ units of college preparatory mathematics; 5 Class Hrs.; 4 Credit Hrs.

14-62 *Mathematical Analysis II*—A continuation of 14-61. Theory of equations, analytical trigonometry, exponential functions, and logarithmic functions. Curve sketching and maxima and minima problems. Prep. 14-61; 5 Class Hrs.; 4 Credit Hrs.

14-63 *Mathematical Analysis III*—A continuation of 14-62. Indefinite integral, progressions, definite integral, and areas. The conic sections and polar coordinates. Prep. 14-62; 5 Class Hrs.; 5 Credit Hrs.

14-64 *Mathematical Analysis IV*—A continuation of 14-63. Hyperbolic functions, De Moivre's theorem, permutations, combinations, probability, and statistics. Prep. 14-63; 5 Class Hrs.; $2\frac{1}{2}$ Credit Hrs.

14-65 *Mathematical Analysis V*—A continuation of 14-64. Methods of integration, approximate integration, volume of revolution, length of arc, surface area of revolution, and average value of a function. Parametric equations, determinants, and vector analysis. Prep. 14-64; 4 Class Hrs.; 4 Credit Hrs.

14-66 *Mathematical Analysis VI*—A continuation of 14-65. Total differential, partial derivatives, multiple integrals, indeterminate forms, and definite series. Prep. 14-65; 4 Class Hrs.; 4 Credit Hrs.

Physics

15-05 *Physics*—A first course in the study of light, the basic principles of wave motion, reflection and refraction of light, mirrors, prisms, lenses, types of spectra and the spectroscope, color, optical instruments, interference and diffraction effects, the diffraction grating, X-ray diffraction, polarization, and light sources are the topics discussed. Lectures, demonstrations, and laboratory experiments on selected topics in mechanics and light. Prep. 15-54; 4 Class Hrs.; 3 Lab. Hrs.; 5 Credit Hrs.

15-06 *Physics*—A first course in sound and heat. The subjects covered in sound are types of wave motion, characteristics of sound, vibrations in strings, rods and air columns, resonance, musical scales and intensity levels. In heat, the topics covered are temperature scales, calorimetry, change of state, expansion of solids, liquids, and gases, the general gas laws, humidity, mechanical equivalent, and transfer of heat. Lectures, demonstrations, and laboratory experiments on selected topics in sound, heat, electricity, and radioactivity. Prep. 15-54; 3 Class Hrs.; 3 Lab. Hrs.; 4 Credit Hrs.

15-11 *General Physics*—The general topic of consideration is a survey of Newtonian mechanics. Specific topics include methods of measurement, laws of rectilinear motion, uniform circular motion, equations of equilibrium, and

mechanics of liquids. Lectures and demonstrations are coupled with problems solvable by algebraic or trigonometric methods only. Prep. 14-23; 6 Class Hrs.; 3 Credit Hrs.

15-12 *General Physics* — A survey of the topics of heat, wave motion, sound, and light with some discussion of the laws of X radiation and radioactivity. Lectures, demonstrations, problems, and laboratory experiments are performed by the students on the above topics and those of 15-11. Prep. 15-11; 3 Class Hrs.; 3 Lab. Hrs.; 5 Credit Hrs.

15-13 *General Physics* — A study of the topics of electricity and magnetism and introductory electronics. Ohm's Law, induced E.M.F.'s, alternating current, telegraphy, and simple vacuum tubes are among topics discussed. Lectures, demonstrations, problems, and laboratory work on the above topics. Prep. 15-12; 3 Class Hrs.; 3 Lab. Hrs.; 5 Credit Hrs.

15-14 *Advanced Physics* — A study of gaseous conduction and its applications, electron emission and basic electron tubes, including the fundamental circuits of electron tubes. This course is for Chemistry majors only and the use of chemistry in the manufacture of electron tubes is stressed. The course time is equally divided between class and laboratory periods. Prep. 14-06, 15-06; 3 Class Hrs.; 2 Lab. Hrs.; 4 Credit Hrs.

15-15 *Advanced Physics* — A brief study of experimental spectroscopy. The topics discussed are the general optical principles of spectroscopic apparatus, prism spectroscopes and spectrographs, the photographic process, slit width and illumination, the diffraction grating, types of mounting for the grating, the Bohr-Sommerfeld atom, the origin of atomic spectra, the spectra of the hydrogen and sodium atoms and quantum numbers. Lectures and laboratory experiments. For Chemistry majors only. Prep. 14-06, 15-06; 3 Class Hrs.; 2 Lab. Hrs.; 4 Credit Hrs.

15-16 *Electricity and Magnetism* — Selected topics not covered in 15-53 and 15-54 are studied, including work in electrostatics, magnetism, direct and alternating currents, electrical units, and Maxwell's equations. This course serves as an intermediate between Courses 15-54 and 15-24. Prep. 15-06, 14-06; 3 Class Hrs.; 3 Credit Hrs.

15-17 *Mechanics* — Vector analysis, Newton's laws of motion, kinematics and dynamics of particles, kinetic and potential energy, conservative forces, central forces, moving co-ordinate systems. Prep. 15-54, 14-06; 4 Class Hrs.; 4 Credit Hrs.

15-18 *Mechanics* — Kinematics and dynamics of systems of particles and rigid bodies, simple and compound pendulums, first and second moments, generalized coordinates, Lagrange's equations, small oscillations. Prep. 15-17, 14-07; 4 Class Hrs.; 4 Credit Hrs.

15-20 *Optics* — After a brief consideration of wave motion, a detailed study is made of interference and Fraunhofer diffraction of light. A thorough understanding of the fundamental principles of physical optics, which the student is encouraged to use in attacking theoretical and experimental problems, is the objective of the classroom discussions. All topics are illustrated by laboratory

experiments, designed to acquaint the student with optical techniques and the handling of instruments of high precision. Prep. 14-06, 15-06; 3 Class Hrs.; 3 Lab. Hrs.; 4 Credit Hrs.

15-21 *Optics* — A continuation of 15-20, with the same general objectives. Diffraction gratings, Fresnel diffraction, and polarization are studied in detail. The latter part of the course is devoted to a consideration of a special topic, for example, spectra, dispersion, Maxwell's equations, which is chosen by the class. All topics are illustrated by laboratory experiments, with increased emphasis on handling instruments of high precision. Prep. 15-20; 3 Class Hrs.; 3 Lab. Hrs.; 4 Credit Hrs.

15-22 *Vibration and Sound* — This course includes a detailed mathematical study of the modes of vibration of strings, pipes, and membranes, with a consideration of vibrating systems in general. A thorough understanding of fundamental principles, which the student is encouraged to use in attacking theoretical and experimental problems, is the objective of the classroom discussions. All topics are illustrated by laboratory experiments, with comparatively simple apparatus, designed to acquaint the student with acoustical techniques. Prep. 14-06, 15-06; 3 Class Hrs.; 3 Lab. Hrs.; 4 Credit Hrs.

15-23 *Vibration and Sound* — A continuation of 15-22, with the same general objectives, this course applies the principles previously studied to the problems of speech, audition, filters, loud-speakers, musical instruments, and the acoustics of auditoriums. All topics are illustrated by laboratory experiments, with more complicated apparatus than that used in the preceding course. Prep. 15-22; 3 Class Hrs.; 3 Lab. Hrs.; 4 Credit Hrs.

15-24 *Electronics* — This course is designed to make the student familiar with the principles, operation, and application of electronic devices. Electron emission, diodes, triodes, tetrodes, pentodes, followed by voltage amplifiers at radio and audio frequencies. Rectifier and filter circuits complete the course. Experiments are performed on all of these topics. Prep. 15-16; 3 Class Hrs.; 3 Lab. Hrs.; 4 Credit Hrs.

15-25 *Electronics* — Continuing the work of the first term with power amplifiers, oscillators, photo tubes, thyatrons. The power amplifier topic includes negative feedback, push pull and radio frequency types. Oscillators are studied at both radio and audio frequencies and of several types. Comprehensive experiments are done on all topics. Prep. 15-24; 3 Class Hrs.; 3 Lab. Hrs.; 4 Credit Hrs.

15-26 *Modern Physics* — A study of molecular relationships, atomic nature of matter and electricity, the corpuscular nature of radiant energy, quantum mechanics, wave theory of matter, atomic structure, spectroscopy and X-ray production and measurement. Prep. 14-06, 15-06; 4 Class Hrs.; 4 Credit Hrs.

15-27 *Modern Physics* — Atomic spectra, molecular spectra, periodic system, radioactivity, alpha-beta-gamma ray spectra, nuclear structure and devices for studying these phenomena are presented. Some time is also given to artificial transmutation processes, fission and cosmic rays. Prep. 15-26; 4 Class Hrs.; 4 Credit Hrs.

15-28 *Electrical Instruments* — This is a laboratory course to acquaint the student with the numerous electrical and electronic instruments that are used in research. Their correct use and limitations are carefully studied. Use is made

of common d-c and a-c instruments, vacuum tube voltmeters of various types, audio oscillators, radio-frequency generators, cathode ray oscilloscopes, audio and radio-frequency bridges, and impedance bridges. The latter part of the course covers the use of several of the instruments in each problem. Prep. 15-25; 2 Class Hrs.; 4 Lab. Hrs.; 4 Credit Hrs.

15-29 *Thermodynamics and Kinetic Theory* — An introduction to heat and the laws of thermodynamics. Kinetic theory as a basis for the thermodynamic laws. Applications. Prep. 14-07, 15-06; 4 Class Hrs.; 4 Credit Hrs.

15-30 *Statistical Mechanics and the Solid State* — The fundamental concepts of Maxwell-Boltzmann, Fermi Dirac and Einstein-Bose statistics with applications to the solid state. Prep. 15-29; 4 Class Hrs.; 4 Credit Hrs.

15-31 *Nuclear Physics* — A chronological outline of the development of theories of the nucleus. Alpha, beta and gamma ray spectra and their interaction with matter. Introduction of the neutrino, pair formation and mesons. Scattering and cross sections. Prep. 14-07, 15-27; 3 Class Hrs.; 3 Credit Hrs.

15-32 *Nuclear Physics* — Introduction to those parts of quantum theory and relativity having a bearing on the study of the nucleus. Nuclear structure, statistics and forces. Majorana, Heisenberg forces and, if time permits, more modern theories. Prep. 15-31; 3 Class Hrs.; 3 Credit Hrs.

15-33 *Quantum Mechanics* — A study of the breakdown of classical theory, the origin of the quantum theory, wave packets and DeBroglie waves, the uncertainty principle, the Schrödinger equation and solution of one dimensional problems. Prep. 14-08, 15-27; 4 Class Hrs.; 4 Credit Hrs.

15-34 *Quantum Mechanics* — This course continues the work of 15-33 and considers three dimensional problems, the hydrogen atom, time independent theory and application to the helium atom. Prep. 15-33; 4 Class Hrs.; 4 Credit Hrs.

15-41 *Introduction to Atomic and Nuclear Physics* — Equivalence of mass and energy, the quantum theory, wave nature of particles, kinetic theory, atomic structure, periodic system, nuclear structure, radioactivity, radioactive decay laws, nuclear reactions, and cross sections. Prep. 14-06, 15-06; 4 Class Hrs.; 4 Credit Hrs.

15-51 *Physics* — The concept of the simple motion of a particle. Displacement, constant and variable velocity and acceleration, relative motion, harmonic motion. Newton's laws, operational concept of momentum and the law of gravitation. 3 Class Hrs.; 3 Credit Hrs.

15-52 *Physics* — Vector and scalar products, physical concept of work, energy, impulse and momentum and the conservation laws. Solution of problems by the above principles and by dynamics. Prep. 15-51; 3 Class Hrs.; 3 Credit Hrs.

15-53 *Physics* — Application of the above principles to rigid bodies, center of mass and gravity, movement of inertia, torque and conservation of angular momentum, rotational energy. Fluid mechanics, Bernoulli's principle, kinetic theory of gases, gas laws, temperature, heat conduction, isothermal and adiabatic processes. Prep. 15-52; 3 Class Hrs.; 3 Credit Hrs.

15-54 *Physics* — The equations of wave motion, reflection, refraction and interference, resonance, Doppler effect, characteristics of sound, oscillations and intensity measurements. Prep. 15-53; 3 Class Hrs.; 3 Credit Hrs.

Physical Education

16-10, 11, 12 *Physical Education* — All first-year students are required to take Physical Education or ROTC. Health, strength and vitality do not come by chance but by constant attention to those factors involved in their development. It is very essential for the student to acquire good habits of living.

The course consists of participation in athletic games and sports.

The program for women consists of team and individual sports, dance, and posture improvement.

Students wishing to be excused from Physical Training because of physical defects are required to present a petition to the faculty supported by a physician's certificate. 2 Lab. Hrs.; 0 Credit Hrs.

16-21 *Principles of Physical Education* — The course considers the place of physical education in the educational program in the United States. The development of physical education programs based on the changes in society from primitive to modern times is discussed, careful attention being given to the needs of the individual, as well as to the needs of the group. Relationship between medical service and the physical education department is considered, and methods of coordination between these two important departments are investigated. The course also includes a consideration of the proper place occupied by interschool and intercollegiate athletics in the physical education program.

Required of all students electing Physical Education as a minor field. 4 Class Hrs.; 4 Credit Hrs.

16-23 *History of Physical Education* — To provide a valuable background for students in this field, this course traces the whole history of physical education from the days of the Greeks and Romans up to the present. Attention is given to special systems of training which have been developed in the United States as well as in foreign countries.

The course is required of all students electing Physical Education as a minor field. 4 Class Hrs.; 4 Credit Hrs.

16-24 *Administration of Physical Education* — This course is designed to acquaint students in the field of physical education with many of the administrative problems which are likely to arise in connection with their work. The subject matter includes a consideration of the objectives of the physical education program, personnel required, and various allied subjects, such as gymnasias, athletic fields and the construction and maintenance of these units. The conduct of the athletic program, including requirements for equipment, arrangements of schedules, coaching, meets, etc., is also included.

Required of all students electing Physical Education as a minor field. 4 Class Hrs.; 4 Credit Hrs.

16-25 *Football* — This course is designed to furnish the student interested in football coaching with a thorough knowledge of the sport. Careful consideration is given to the fundamentals in discussing the plays of each position in the line and backfield. Various well-known offensive and defensive systems are discussed for the purpose of considering their general merits, as well as adaptations to

particular situations. Training and conditioning, rules and interpretation, and officiating are given proper attention. 4 Class Hrs.; 4 Credit Hrs.

16-26 *Track and Field Events* — This course considers the care and training of track athletes. Practice schedules, selection of material, conduct of meets, etc., are discussed. The viewpoint from which the topics are treated is that of the student of coaching technique. In connection with this course, action pictures taken from actual performances by world champions, together with moving pictures, are of great value in demonstrating the style and technique of track and field events. 4 Class Hrs.; 4 Credit Hrs.

16-27 *Basketball and Baseball* — The baseball section of the course covers with reasonable completeness the job of the coach in either high school or college to properly administer the sport. The techniques of individual and team play in fundamentals and strategy are covered to make for a well-rounded program.

The basketball section of the course deals with organization and conducting basketball as a phase of interschool competition. Basic fundamentals and techniques as well as the different systems of individual and team play as employed in the major schools of the country are stressed. 4 Class Hrs.; 4 Credit Hrs.

Natural Sciences

17-01 *Survey of Physical Sciences* — This sequence of courses is designed to give students a broad understanding and appreciation of the various physical sciences. This term begins with an introduction to the nature of science and how science develops with most illustrations drawn from the history of astronomy. Current astronomical ideas follow the historical background and the term closes with a study of the laws of motion and their applications in astronomy and current experimentation in space vehicles. Demonstrations, visual aids, and field trips are used in this and the succeeding terms whenever applicable. 3 Class Hrs.; 3 Credit Hrs.

17-02 *Survey of Physical Sciences* — A continuation of 17-01 with major emphasis placed in the field of physics. The study of simple machines, work and power is followed by an introduction to basic principles of heat and electricity. A study of sound waves and of physical and geometric optics completes this term. 3 Class Hrs.; 3 Credit Hrs.

17-03 *Survey of Physical Sciences* — In this term the rock and mineral composition of the earth and the forces which govern the physical features of the earth are studied. Following this introduction to physical geology a study is made of the atmosphere, weather elements, and weather forecasting. 3 Class Hrs.; 3 Credit Hrs.

17-04 *Survey of Physical Sciences* — This short term is devoted to a study of chemistry. After an introduction to basic chemical concepts the attention is directed to nuclear chemistry with emphasis being placed on a better understanding of atomic energy. 4 Class Hrs.; 2 Credit Hrs.

17-11 *Introduction to Natural History* — This course is designed (as is the one following) specifically for the elementary school teacher. The primary purpose is to provide the teacher with a fund of knowledge in natural history on which she can draw when confronted by the innumerable questions of the elementary school child. In this term attention will be directed to animals of the seashore, spiders, insects, amphibians, and reptiles. In each of these groups specific animals will be studied in detail as to their identifying characteristics, life history, special peculiarities, ecological relationships and economic importance. 3 Class Hrs.; 3 Credit Hrs.

17-12 *Introduction to Natural History* — In this course the study of fish, birds and mammals completes the study of the natural history of the animal kingdom. The latter half is devoted to the natural history of algae, fungi, mosses, ferns, and higher plants. In 17-11 and 17-12 considerable emphasis will be placed on individual and group field trips. At least one special project will be required in each course. 3 Class Hrs.; 3 Credit Hrs.

Economics

20-01 *Economic Geography* — After a presentation of the broad field of study in economic geography, this course concentrates upon the fundamental geographic and geologic facts and principles that are necessary to an understanding of basic economic institutions. 3 Class Hrs.; 3 Credit Hrs.

20-02 *Economic Geography* — This course continues the study in economic geography by examining the available and potential resources and institutions of the different countries and areas of the world. Prep. 20-01; 3 Class Hrs.; 3 Credit Hrs.

20-04 *Introduction to Economics* — This course will discuss the problems basic to all economic societies. It is intended to give the student a survey of the more important aspects of the American economy. Attention will be given to such topics as national income, its fluctuations, the banking system, labor, business organization, etc. The course approach will primarily be an institutional one. 3 Class Hrs.; 3 Credit Hrs.

20-05 *Economic Geography* — This course analyzes the geography and the economic resources of the world, particularly those of the United States. Emphasis is placed upon the part played by these factors in the development of our modern industrial society and upon world affairs. 4 Class Hrs.; 4 Credit Hrs.

20-06 *Principles and Problems of Economics* — An introduction to economic theory and the major problems confronting the United States economy. Topics studied include the major institutions of our economy, business cycles, money and the banking system, fiscal policy, and the factors affecting economic growth. Analysis of fluctuations in national income is the principal focus of study. Textbook and supplementary readings are required. 4 Class Hrs.; 4 Credit Hrs.

20-07 Principles and Problems of Economics — A course in the principles of price determination under competitive and monopolistic conditions, the distribution of wealth and income, the nature of international trade, problems of economic development, and comparative economic systems. Textbook and supplementary readings are required. 4 Class Hrs.; 4 Credit Hrs.

20-09 Introduction to Statistics (Graphical Presentation) — This course presents the fundamentals of the graphic language as it is employed in business and industrial relationships and is intended to facilitate a better understanding between the fabrication and marketing phases of industrial products. It includes a study of drawing equipment and its use, lettering, geometric constructions, multiplaner orthographic projection, freehand and technical sketching, pictorial representation, and elements of dimensioning, with a study and interpretation of drawings from the various industrial fields. 3 Class Hrs.; 6 Lab. Hrs.; 3 Credit Hrs.

20-11 Economics — After an analysis of the main characteristics of our modern economic order, attention is focused on the problems of the determination of national income, the causes and consequences of business cycles, inflation and deflation, the banking system, and monetary and fiscal policy. 3 Class Hrs.; 3 Credit Hrs.

20-12 Economics — A continuation of 20-11. Analysis of the principles of price determination; the distribution of income into wages, rent, interest and profits; the nature of international trade; problems of economic development; and comparative economic systems. 3 Class Hrs.; 3 Credit Hrs.

20-13 Economic Principles — This course is designed to give the student a thorough grounding in the fundamental laws and principles of economic analysis. The main topics will be microeconomic in nature including the topics of demand, supply, and pricing under various market conditions. In addition to price theory, the student will be introduced to the basic concepts of distribution, particularly with respect to the demand for productive factors and the returns to these factors. The entire area of microeconomic analysis will be unified into a total equilibrium concept. 8 Class Hrs.; 4 Credit Hrs.

20-14 Economic Problems — In this course the application of economic principles to some of the major economic problems of modern society is emphasized. The problems studied include consumption, international economic relationships, labor problems such as wages, unemployment, social security, and collective bargaining and the business cycle. Prep. 20-13; 4 Class Hrs.; 4 Credit Hrs.

20-15 Economic Problems — A continuation of 20-14 Economic Problems. Among the problems considered are the following: price stabilization, the agricultural problem, the relation of government to business, including the control of monopolies and public utilities, public finance, and proposals for the remodeling and improving of the economic system. Prep. 20-14; 4 Class Hrs.; 4 Credit Hrs.

20-16 Accounting Principles — A course in accounting designed for those who must have a fundamental knowledge of accounting procedures and techniques. It covers both the recording and the interpretative aspects of accounting. 4 Class Hrs.; 4 Credit Hrs.

20-17 *Accounting Principles* — A continuation of 20-16 in which the student is presented with a more comprehensive coverage of the accounting for partnership and corporate forms of business organization. The financial and interpretative aspects of partnership and corporation accounting are presented. Prep. 20-16; 4 Class Hrs.; 4 Credit Hrs.

20-18 *American Economic History* — The economic development of the United States is traced from the colonial period to the present with special emphasis upon the period since the Civil War. Stress is laid upon the importance of economic factors and changes in our history in the description of the development of manufacturing, agriculture, domestic and foreign commerce, finance and banking, transportation and labor organizations. Consideration is given to European developments which have been closely related to those of the United States. Prep. 20-11 or 20-13; 4 Class Hrs.; 4 Credit Hrs.

20-20 *Statistics* — This course is intended to give the student an understanding of statistical principles and methods and their practical application. A study is made of the nature, sources, collection, and organization of statistical facts; the presentation of such facts in tabular or graphic form; the various averages, measures of dispersion; and probability theory, including the bases of quality control. Laboratory periods provide an opportunity for each student to demonstrate his ability to apply the principles studied. 3 Class Hrs.; 2 Lab. Hrs.; 4 Credit Hrs.

20-21 *Statistics* — The major portion of this continuation of 20-20 involves three subjects: time series analysis, including methods of obtaining trends, seasonal indexes, and the measurement of cyclical variation; correlation analysis and the construction and use of index numbers. Prep. 20-20; 3 Class Hrs.; 2 Lab. Hrs.; 4 Credit Hrs.

20-22 *Industrial Statistics I* — The increasing use of statistics in business and in the field of industrial engineering makes essential an understanding of the fundamental methods and applications of statistical analysis. These are studied from the point of view of the user of statistical data. A study is made of the nature, sources, collection, and organization of statistical facts; the presentation of such facts in tabular or graphic form; the various averages and measures of dispersion. A part of the course is devoted to time series analysis and a basic presentation of the construction and use of index numbers. 4 Class Hrs.; 4 Lab. Hrs.; 3 Credit Hrs.

20-24 *Money and Banking* — This course covers the institutional aspects of our monetary and banking system. Considerable attention is also directed toward the problems and policies of central banking in the United States. Prep. 20-07 or 20-15; 4 Class Hrs.; 4 Credit Hrs.

20-25 *Business Cycles* — This course covers the causes of unstable equilibrium and the ways it is measured, with its effect on our economy. Methods of making short-range and long-range forecasting; sources of material on business conditions and sequence and amplitude of this material are covered next. Finally the forecasting services are analyzed and current business conditions studied. Prep. 20-15; 4 Class Hrs.; 4 Credit Hrs.

20-26 *Labor Economics* — This course covers an analysis of the labor force and of the development of unions and collective bargaining as a part of American industry; management and union policies in labor relations; the content and issues in bargaining over agreements; the labor market in relation to employment, wages and income levels; government influence in regard to management-union relations, union responsibility, industrial disputes and labor standards. Prep. 20-14; 3 Class Hrs.; 3 Credit Hrs.

20-27 *International Economic Relations* — A systematic survey of the development of international commercial policies in recent times. Changes in the structure of the world economy are examined, especially those that have occurred since World War I. The basic principles needed to understand modern commercial policy are developed, and the policies of individual nations and international organizations are analyzed in the light of these principles. Prep. 20-14; 4 Class Hrs.; 4 Credit Hrs.

20-28 *Economic Systems* — After developing criteria for evaluating the different economic systems, the course proceeds to a comparative analysis of capitalism, co-operation, socialism, communism, and fascism. The problems of economic planning receive particular attention. Prep. 20-15; 4 Class Hrs.; 4 Credit Hrs.

20-29 *Intermediate Economic Theory* — This course encompasses the traditional areas of classical equilibrium theory. The determination of price under varying market conditions is examined under partial equilibrium assumptions along with production theory. Under demand analysis the utility and indifference techniques are compared; while the use of iso-curves is extended into the area of production and the demand for productive factors. 4 Class Hrs.; 4 Credit Hrs.

20-30 *Intermediate Economic Theory* — This is a continuation of 20-29 completing the theory of distribution and finishing microeconomic analysis with the presentation of the Walrasian System of total equilibrium. The material then shifts to macroeconomic models, with emphasis upon employment levels, national income analysis, interest rates, and savings-consumption-investment problems. Some examination is carried out of statistical consumption functions and in the final phase Keynesian economics is compared with the classical models. 4 Class Hrs.; 4 Credit Hrs.

20-31 *Advanced Economic Theory* — This course introduces the advanced elements of macroeconomics. National income concepts are carefully reviewed and theories of income determination assayed. The importance of aggregative relationships (consumption, saving, and investment) in the theory of employment is emphasized. The principal concern is the presentation and development of modern analytical instrumentalities of analysis within the framework of macroeconomics. Prep. 20-30; 4 Class Hrs.; 4 Credit Hrs.

20-32 *Advanced Economic Theory* — This course introduces the advanced elements of microeconomics. Demand and supply concepts are reviewed comprehensively with respect to neo-classical partial equilibrium analysis. The modern treatments of utility maximization within the household, profit maximization within the individual firm, and the differentiation among equilibrium solutions within varying market structures are stressed. Simple presentations of advanced analytical techniques employing more than bi-variable relationships are included. Prep. 20-21; 4 Class Hrs.; 4 Credit Hrs.

20-40 *Business and Government* — This course is directed toward the development of an understanding of the part played by government (local, state, national) in economic affairs, both directly and indirectly, and of the relationships between business and government. The attitude of government toward business and toward the economic institutions affecting business, as evidenced by legislative, judicial, executive and administrative actions will be analyzed. Prep. 20-15; 4 Class Hrs.; 4 Credit Hrs.

20-51 *Public Finance* — This course deals with the problems of taxation and expenditure on federal, state and local levels. Fiscal policies of the federal government and intergovernmental fiscal relationships are also considered. Prep. 20-07 or 20-15; 4 Class Hrs.; 4 Credit Hrs.

20-54 *Introduction to Marketing* — A study of the selling principles and practices of our markets. 5 Class Hrs.; 2½ Credit Hrs.

20-55 *Introduction to Advertising* — A study of the underlying principles of advertising and the tools used in applying these principles. 5 Class Hrs.; 2½ Credit Hrs.

20-57 *Business Management* — An introductory survey of the principles and problems of business management. (Not open to students who have had 45-21 Principles of Business Management.) 5 Class Hrs.; 2½ Credit Hrs.

20-58 *Personal Finance* — This course will deal with the planning of personal expenditures, setting up an insurance program, and building an estate. Prep. 20-12 or 20-13; 5 Class Hrs.; 2½ Credit Hrs.

20-59 *Federal Income Taxes* — This course is designed to provide a brief survey of the Federal tax structure and to provide some training in the application of tax principles to specific problems. (Not open to Accounting majors.) Prep. 20-17 or 41-03; 5 Class Hrs.; 2½ Credit Hrs.

20-65 *Research Methods* — This course provides a thorough grounding in the methods of statistical inference and their application to business and economic research. The theory of probability, the basic tests of significance, Chi-square and analysis of variance are covered. The theory of sampling and some practical problems encountered in making sample surveys are also discussed. Admission is limited to qualified seniors on approval of the instructor. Prep. 20-21; 4 Class Hrs.; 4 Credit Hrs.

Education

Methods and Materials in the Teaching Major — For Secondary School Teaching

21-20 *English*

21-21 *Foreign Languages*

21-22 *Science*

21-23 *Mathematics*

21-25 *Social Studies*

21-26 *General Business*

21-27 *Secretarial Science*

21-28 *Industrial Arts*

To apply the understanding of teaching principles previously developed to the specific teaching major, to utilize the sources and materials available to

meet such problems as setting up developmental programs in the subject field. 3 Class Hrs.; 3 Credit Hrs.

Specialized Areas for Elementary School Teaching

21-31 *Elementary Language Arts* — An intensive study of the methods and materials for the teaching of the language arts in the elementary school program. Available tools and resources are emphasized. 3 Class Hrs.; 3 Credit Hrs.

21-32 *Reading in Elementary Schools* — A study of the specific methods and materials necessary to develop a sound and continuous program of reading in the elementary grades, including techniques, tools and ways of meeting individual differences. 3 Class Hrs.; 3 Credit Hrs.

21-33 *Elementary School Arithmetic* — An intensive study of the methods and materials now available to develop a sound and meaningful program in elementary arithmetic. 3 Class Hrs.; 3 Credit Hrs.

21-35 *Elementary School Science* — A study of ways in which interest in and understanding of the elementary school students' natural environment can be developed. 3 Class Hrs.; 3 Credit Hrs.

21-37 *Arts and Crafts in Elementary Schools* — Students will be expected to work with materials appropriate to an art program at the elementary school level such as stenciling, block printing, lettering, crayon, papier-mache, etc. 3 Class Hrs.; 3 Credit Hrs.

21-38 *Music in the Elementary School* — A course designed to emphasize method and materials helpful in developing an elementary school music program. 3 Class Hrs.; 3 Credit Hrs.

21-39 *Elementary School Social Studies* — An intensive study of materials, resources, tools and methods needed to organize a thoroughly sound program in elementary social studies. 3 Class Hrs.; 3 Credit Hrs.

21-40 *Student Teaching with Related Seminar* — Here the student is provided opportunity in a public school to assume responsibility for organizing learning experiences in his major area under expert supervision. Separate seminars for elementary and secondary majors meeting weekly will run concurrently with the student teaching periods and deal with problems encountered in the classroom. 14 Credit Hrs.

21-45 *Growth and Development* — Consideration is given to the major factors related to human growth and development. These include heredity, maturation emotions, social relationships, and intelligence. Emphasis is placed upon the importance of learning and adjustment in relation to growth and development. 8 Class Hrs.; 4 Credit Hrs.

21-49 *Health and Recreation* — A basic course covering the scope, methods and materials of the elementary school physical education program. Consideration will be given to general first aid measures. 3 Class Hrs.; 3 Credit Hrs.

21-50 *Special Education* — To acquaint the student with the nature and problems of exceptional children, including the retarded, the gifted, those with speech and hearing defects, brain injury, etc. 3 Class Hrs.; 3 Credit Hrs.

21-51 *Human Development and Learning I* — Designed to familiarize students with the developmental processes of elementary school children. Particular attention will be given to physical growth, intellectual growth, language development and social development. Prep. Social Science or Sociology; 3 Class Hrs.; 3 Credit Hrs.

21-52 *Human Development and Learning II* — This course will consider changing attitudes and concepts during adolescence. Attention will be given to individual differences in development and performance, as related to physical, social and psychological factors. Prep. 21-51; 3 Class Hrs.; 3 Credit Hrs.

21-53 *Learning and Teaching* — Major emphasis is upon intensive study of the learning process. Conditions for effective retention and transfer of learning, uses of sociometric techniques, and the teacher's role within the total school setting are included. 3 Class Hrs.; 3 Credit Hrs.

21-53E *Learning and Teaching — Elementary Laboratory* — A laboratory course for students preparing to teach in the elementary school and concurrently enrolled in 21-53. Emphases are upon the development of principles for transfer, an examination of studies in perception and retention, construction of sociometric devices, and evaluation of various teaching procedures. 2 Lab. Hrs.; 2 Credit Hrs.

21-53S *Learning and Teaching — Secondary Laboratory* — A laboratory course for students preparing to teach in the secondary school and concurrently enrolled in 21-53. Emphases are upon the development of principles for transfer, an examination of studies in perception and retention, construction of sociometric devices, and evaluation of various teaching procedures. 2 Lab. Hrs.; 2 Credit Hrs.

21-54 *Learning and the Curriculum* — The relationship of principles of learning to curriculum development is studied. Topics treated include: the concept of unit organization; the functions of measurement and evaluation; procedures of classroom management; and sources of authority for curriculum building. 3 Class Hrs.; 3 Credit Hrs.

21-54E *Learning and the Curriculum — Elementary Laboratory* — A laboratory course for students preparing to teach in the elementary school and concurrently enrolled in 21-54. Emphasis is upon the application of curriculum theory through the development of units and such related implements as lesson plans, evaluation instruments, and audio-visual materials. Opportunity is provided for planned classroom observation in an elementary school. 2 Lab. Hrs.; 2 Credit Hrs.

21-54S *Learning and the Curriculum — Secondary Laboratory* — A laboratory course for students preparing to teach in the secondary school and concurrently enrolled in 21-54. Emphasis is upon the application of curriculum theory through the development of units and such related implements as lesson plans, evaluation instruments, and audio-visual materials. Opportunity is provided for planned classroom observation in a secondary school. 2 Lab. Hrs.; 2 Credit Hrs.

21-55 *Backgrounds of American Education I* — A study of the historical and philosophical roots of American schools, their old world origins, the early formulations of American education up to the Civil War. 3 Class Hrs.; 3 Credit Hrs.

21-55S *Backgrounds of American Education I* — A course for summer students comparable with 21-55. 5 Class Hrs.; 2½ Credit Hrs.

21-56 *Backgrounds of American Education II* — An extension of 21-55, especially the development of education in America since 1865, together with the developing and conflicting philosophies of idealism, realism, pragmatism. Major current issues are analyzed and discussed. Prep. 21-55; 3 Class Hrs.; 3 Credit Hrs.

21-56S *Backgrounds of American Education II* — A course for summer students comparable with 21-56. 5 Class Hrs.; 2½ Credit Hrs.

21-60 *Social Science I* — The biological evolution of man and factors influencing his development. Types and relationships of early men. Origins and significance of races. The meaning of evolutionary processes and consideration of the concept of progress in evolution. 3 Class Hrs.; 3 Credit Hrs.

21-61 *Social Science II* — Factors influencing the cultural development of man. Methods of analysis utilized by anthropologists. The significance of culture and society; language; cultural transmission, diffusion, variability, and change. Specific studies of contemporary primitive peoples, illustrating various cultural levels. Prep. 21-60; 3 Class Hrs.; 3 Credit Hrs.

21-62 *Social Science III* — The contributions of social scientists in developing understanding of formal and informal social relations. Consideration of the individual in society, communities, institutions, social classes, social processes and change, contemporary trends and problems. Emphasis upon modern society. Prep. 21-61; 3 Class Hrs.; 3 Credit Hrs.

21-65 *Psychology of Learning* — A first course in the psychological principles and processes involved in effective learning and thinking. Topics such as: Kinds of learning, problem-solving behavior and concept formation are considered. 3 Class Hrs.; 3 Credit Hrs.

Government

22-01 *American National Government* — The term's work consists of a study of the Constitution, civil rights, and problems of Federalism. Upon this foundation, the remainder of the term is concerned with Political Parties and Public Opinion. 3 Class Hrs.; 3 Credit Hrs.

22-02 *American National Government* — A study is made of the organization and work of the Legislative, Executive, and Judicial branches of the government. In addition, problems in personnel, finance, and foreign relations are discussed. 3 Class Hrs.; 3 Credit Hrs.

22-03 *American National Government* — This term's work is concerned with the scope and purpose of government activities and how these activities promote the general welfare. Specific topics such as government concern with business, agriculture, conservation and labor will be studied. 3 Class Hrs.; 3 Credit Hrs.

22-06 *State and Local Government* — The legal bases of state and local government as determined by constitutions are studied. After considering the structure of state and local government the remaining time will be spent in studying the various services of state and local government. 3 Class Hrs.; 3 Credit Hrs.

22-08 *Current Political Issues* — This course is designed to present a broader understanding of contemporary national and international issues. Conflicting ideologies, protection of civil rights, and specific issues in American foreign affairs are covered. 3 Class Hrs.; 3 Credit Hrs.

22-10 *American Political Parties* — A study of the origin, development, organization, principles, and programs of political parties in the United States. Consideration is also given to the influence of pressure groups on party government. 4 Class Hrs.; 4 Credit Hrs.

22-11 *Foreign Governments* — This course is concerned with the origin and development of parliamentary government as found in England and France. 4 Class Hrs.; 4 Credit Hrs.

22-12 *Foreign Governments* — This course is primarily concerned with the government of the Soviet Union. The government of Germany or Italy is studied in concluding the term's work. 4 Class Hrs.; 4 Credit Hrs.

22-13 *Political Theory* — This course is concerned with such basic ideas as justice, liberty, and the organization of the state as expressed by writers from Plato through Machiavelli. 4 Class Hrs.; 4 Credit Hrs.

22-14 *Political Theory* — The course opens with the writers of the Protestant Reformation followed by Royalist and anti-Royalist theorists; social contract writers, and the utilitarians. Communist political philosophy and Democracy's answer to it concludes the course. 4 Class Hrs.; 4 Credit Hrs.

22-15 *American Constitutional Law* — This course is a case study of American federalism; judicial review; the commerce, fiscal, military, and other powers of Congress and the powers of the President in domestic and foreign affairs. 4 Class Hrs.; 4 Credit Hrs.

22-16 *American Constitutional Law* — This course is a case study of state power to regulate economic affairs and to tax; rights of the accused; freedom of expression; electoral process; citizenship and alienage; intergovernmental immunities; interstate relationships. 4 Class Hrs.; 4 Credit Hrs.

22-17 *International Politics* — This course considers the principles underlying international politics. Foundations of power such as geography, ideas, and nationalism are analyzed. The problem of world law and order in the contemporary international setting is emphasized. 4 Class Hrs.; 4 Credit Hrs.

22-18 *International Organization* — This course covers historical backgrounds; the League of Nations; the structure, functions, and problems of the United Nations and its specialized agencies. It concludes with an analysis of world government. 4 Class Hrs.; 4 Credit Hrs.

22-20 *Public Administration* — The existing administrative structure and efforts at reorganization are studied. The course explores those principles which should determine administrative organization and practice, and considers problems of finance administration. 4 Class Hrs.; 4 Credit Hrs.

22-21 *Public Administration* — This course develops personnel administration in some detail and examines the problem of holding administrative officers responsible by means of statutory limitations, judicial review, and other less formal methods. 4 Class Hrs.; 4 Credit Hrs.

22-22 *International Law* — This course studies such topics as recognition, treaties, relation of international law to municipal law, treaties, state responsibility, and interpretation of the United Nations Charter. Problems inherent in modernizing the law of nations are stressed. 4 Class Hrs.; 4 Credit Hrs.

22-23 *American Foreign Policy* — This course concentrates on the role of the United States in world politics. Analysis of factors affecting American foreign policy, governmental mechanism for its conduct, and specific contemporary problems receive stress. 4 Class Hrs.; 4 Credit Hrs.

22-24 *American Political Thought* — This course traces the development of formative political ideas from the colonial period to the Civil War. Topics for study include: Puritanism, enlightenment theories of representation and revolution, constitutionalism, Jeffersonian and Jacksonian democracy, and theories supporting national union and states' rights. 4 Class Hrs.; 4 Credit Hrs.

22-25 *American Political Thought* — This course continues the examination of political theory in the United States from the post-Civil War period to the present time. Topics include economic liberalism, progressivism, pragmatism, concluding with an examination of current theories of liberalism and conservation. 4 Class Hrs.; 4 Credit Hrs.

22-28 *Modern Middle East* — A political and historical survey of the Modern Middle East. Special reference will be made to the problems of feudalism and nationalism, and to ethnic and religious minorities. This survey will include the Arab States and Principalities, Iran, Israel, and Turkey. 2½ Class Hrs.; 5 Credit Hrs.

22-30 *Soviet Foreign Policy* — This course concentrates on the role of the Soviet Union in world politics from 1917 to the present. Historical background and analysis of factors affecting Soviet foreign policy, governmental mechanism for its conduct, and specific contemporary problems receive stress. 2½ Class Hrs.; 5 Credit Hrs.

History

23-01 *Western Civilization* — This course traces human development from stone age cultures to the emergence of democracy in Greece. Religious and institutional contributions of ancient Near Eastern civilizations, and political, artistic, and philosophical contributions of Greece to modern civilization are studied. 4 Class Hrs.; 4 Credit Hrs.

23-02 *Western Civilization* — This course studies the rise and decline of Roman civilization, the background and development of Christian ideas and institutions, the Germanic and Islamic assault on Europe, and the consequent collapse and new beginnings of Western Civilization during the Middle Ages. 4 Class Hrs.; 4 Credit Hrs.

23-03 *Western Civilization* — This course examines the steps in the transformation of Europe, socially, politically, and intellectually in the era beginning with the high Middle Ages and ending with the early aspects of the Age of Science. 4 Class Hrs.; 4 Credit Hrs.

23-04 *Western Civilization* — This course emphasizes the compelling intellectual basis for economic, social, and political changes in Europe during the revolutionary 18th and 19th centuries. Study of the industrial revolution and the Darwinian intellectual revolution renders the 20th century more understandable. 4 Class Hrs.; 2 Credit Hrs.

23-05 *Recent American History* — This course emphasizes the important role which must be assigned to the Darwinian intellectual revolution in shaping 20th century American political, social, and economic ideas and legislation as well as the international developments resulting in American leadership in the free world against totalitarianism. 4 Class Hrs.; 4 Credit Hrs.

23-06 *Recent European History* — This course concerns Europe in the turbulent years since 1914 when the Darwinian spirit of conflict has been dominant. Military aspects of both World Wars, postwar dislocations, Communism, Fascism, and European attempts to achieve unification are major topics. 3 Class Hrs.; 3 Credit Hrs.

23-07 *History of Soviet Russia* — The objective of this course is the creation of an understanding of the forces which molded and continue to mold Soviet Russia. The course begins with the closing decade of Imperial Russia and considers social, economic, and intellectual factors in close correlation with important political developments. 4 Class Hrs.; 4 Credit Hrs.

23-08 *Contemporary Orient* — This course concerns 20th century India and the Far East, their basic heritage, present institutions and programs, and their importance to American foreign policy. Special emphasis is placed upon the career of Gandhi and his non-violent alternatives to war. 4 Class Hrs.; 4 Credit Hrs.

23-09 *Ancient Greece* — This course concerns the origins and development of Greek civilization; the political evolution of Hellenic society from tribal to city-state organization; and the growth and application of Greek religious, political, and ethical ideas. Prep. 23-01; 4 Class Hrs.; 4 Credit Hrs.

23-10 *Ancient Rome* — This course examines Roman civilization in two sequences; the rise of Roman power under the Republic; the decline of Roman power under the Empire. Inquiry is made into the social, economic, intellectual, and religious expressions of each sequence. Prep. 23-02; 4 Class Hrs.; 4 Credit Hrs.

23-11 *Eighteenth Century Europe (1700-1815)* — This is a study of Europe in the Age of Enlightenment when Newtonian concepts were advanced to suggest sweeping changes in government and society. The course emphasizes the French Revolutionary era and its impact on European thought and institutions. 4 Class Hrs.; 4 Credit Hrs.

23-12 *Nineteenth Century Europe (1815-1914)* — This is a study of Europe during a century of dramatic transformation. The Post-Napoleonic reaction, the Industrial Revolution, Liberalism, Socialism, Nationalism, the rise of imperialism, and the diplomatic background of World War I are major topics. 4 Class Hrs.; 4 Credit Hrs.

23-13 *England to 1720* — This course studies English history from its beginnings to the Age of Walpole. Church versus State; the growth and transformation of English social classes; and the origin and growth of English constitutional and political ideas receive emphasis. 4 Class Hrs.; 4 Credit Hrs.

23-14 *England since 1720* — This course emphasizes the determining role of the Newtonian and Darwinian intellectual revolutions in shaping English ideas leading to the *Age of Reform* and the emergence of England in the 20th century as a socialist democracy. 4 Class Hrs.; 4 Credit Hrs.

23-15 *English Constitutional History* — This course studies the English constitution and common law; local government versus central government; the origin and growth of Parliament; the development of the British cabinet system; and a comprehensive study of statutes and documents. 4 Class Hrs.; 4 Credit Hrs.

23-16 *American Constitutional History* — This course concerns the historical development of the Constitution of the United States with particular emphasis on its progressive adjustment to the changing social and economic order. 4 Class Hrs.; 4 Credit Hrs.

23-17 *American History to 1820* — This course examines the foundations and early development of modern American institutions, ideals, and mores with emphasis on the growth of a distinct American character and the gradual evolution of American democracy. 4 Class Hrs.; 4 Credit Hrs.

23-18 *The United States 1820-1890* — This course concerns the Civil War, its background and its aftermath. The rise of democracy, the sectional struggle, the era of geographical and economic expansion, and American social problems are seen against this backdrop. 4 Class Hrs.; 4 Credit Hrs.

23-19 *Latin America to 1810* — This course emphasizes the American Indian and Spanish cultures and their fusing in the New World subsequent to Spanish conquest. The forces, both American and European, which gave rise to the Latin American wars of independence receive special study. 4 Class Hrs.; 4 Credit Hrs.

23-20 *Latin America since 1810* — This course deals with the rise of the great nations of Latin America, the development of extreme nationalism, foreign ideologies, and relationships between the United States and Latin American nations. 4 Class Hrs.; 4 Credit Hrs.

23-21 *History of Mexico* — This course will include a brief treatment of the background of modern Mexico, with the main emphasis on the events since the Mexican Revolution of 1910 and on relations with the United States. 4 Class Hrs.; 2 Credit Hrs.

23-22 *The Early Middle Ages* — This course traces the history of Europe from the decline of the Roman Empire through the early years of the thirteenth century. Particular attention will be paid to the classical heritage of the Middle Ages, the development of Christianity and the growth of the Medieval Church, the rise of trade, commerce and towns, and the emergence of universities in Western Europe. 4 Class Hrs.; 4 Credit Hrs.

23-23 *The Renaissance and Reformation* — This course traces the history of Europe from the thirteenth to the seventeenth centuries. The decline of the church and the rise of the Protestant sects, Humanism and the various aspects of the new learning, the development of the nation states, the growth of international trade and capitalism, and the Turkish threat to the West will all be emphasized. 4 Class Hrs.; 4 Credit Hrs.

23-25 *Eastern Civilization to 1000 A.D.* — This course concerns the origin and growth of civilization in India, Iran, China, and Japan to 1000 A.D. Basic religious and philosophical ideas which helped to mold social patterns, political institutions, and creative literature and art receive emphasis. 4 Class Hrs.; 4 Credit Hrs.

23-26 *Eastern Civilization since 1000 A.D.* — This course studies the impact of Islam upon Iran and India; the Mongol and Turkish conquests; and the decline of Asiatic power resulting from European explorations and imperialism. Study of the culture conflict between Eastern and Western civilizations concludes the course. 4 Class Hrs.; 4 Credit Hrs.

23-28 *History of Primitive Religion* — This course studies theories concerning the origin of religion in the light of anthropological studies into the religious beliefs and practices of selected primitive societies in Australasia, Africa, Asia, the Arctic, and the Americas. 4 Class Hrs.; 4 Credit Hrs.

23-29 *History of State Religions of Antiquity* — This course examines the earliest historical religious growth beyond the primitive whereby state governments undertook, through religious rites, to insure the welfare of citizenries. Examples studied include Egyptian, Sumero-Babylonian, Greek, Roman, Chinese, Japanese, and early American-Indian state religions. 4 Class Hrs.; 4 Credit Hrs.

23-30 *Modern Democracy* — The central theme in the courses, 23-30 and 23-31, is the struggle between Communism and Democracy. The first term deals with the development of Communism in Russia and elsewhere and its struggle against Democracy. 3 Class Hrs.; 3 Credit Hrs.

23-31 *Modern Democracy* — This course deals with the background, rise and evolution of American Democracy. Emphasis is given to its strengths and weaknesses in its conflict with Communism. 3 Class Hrs.; 3 Credit Hrs.

Philosophy

24-01 *Introduction to Philosophy* — Basic meanings, issues, and structures are first presented. The chief fields, the interpenetrations with the several arts and sciences, the schools of thought, and the methodologies are then studied. Presented both as a body of knowledge and as a way of thinking, philosophy is viewed in this course as a set of data and values essential to the better understanding of human experience. Epistemological and teleological considerations are emphasized. 4 Class Hrs.; 4 Credit Hrs.

24-02 *Problems of Philosophy* — Problems arising both from what we do know and from what we do not know about the complex nature of human experience are studied and systematized. Data from such fields as semantics, logic and psychology are introduced to throw light on the problems at hand. The persistent problems in epistemology, teleology and metaphysics are examined. The validity of knowledge, the mind-body dilemma, and freedom of will are representative topics. Prep. 24-01; 4 Class Hrs.; 4 Credit Hrs.

24-03 *History of Philosophy* — Historical survey, beginning with the early Greek period. The personalities and principles are studied as a basis for constructing a continuing sense of philosophical thought and comparative analysis. The course progresses through the patristic and scholastic eras. Prep. 24-02; 4 Class Hrs.; 4 Credit Hrs.

24-04 *History of Philosophy* — Studying the transitional era following the Medieval period, the historical survey considers the great ideas and systems of thought down through the modern era. Special attention is given present-day contributions. Prep. 24-03; 4 Class Hrs.; 4 Credit Hrs.

24-05 *Philosophy of Religion* — Types of religious belief and practice are analyzed and evaluated from the philosophical point of view. Problems related to the nature of God, validity of religious claims, human freedom, immortality, and natural evil are studied. Theological and ethical considerations are introduced. 4 Class Hrs.; 4 Credit Hrs.

24-06 *Logic* — Modified or practical logic is stressed in this course; formal and classical structures are given limited attention. Fallacies resulting from semantic confusion and methodological error are noted. The meanings of causality and the several types of thinking are examined. Practice drills in effective thought processes and clearer verbalization are emphasized. 4 Class Hrs.; 4 Credit Hrs.

24-13 *Ethics* — To clarify the meaning of morality in social relations is the aim of this study. Right and wrong conduct is analyzed in the light of the highest values for human society. Moral laws are discussed and the various systems of ethics are evaluated. Scientific attitudes are encouraged in order that one's moral judgments may be compatible with one's best reflective thought. 4 Class Hrs.; 4 Credit Hrs.

24-14 *Ethics* — Problems arising from differences in moral standards found in the various social groups will be examined. The question of ethical relativism and determinism will be considered. A selected number of specific problems in social ethics will be discussed. 4 Class Hrs.; 4 Credit Hrs.

24-40 *Elements of Philosophy* — After discussing the preliminary concepts and categories, the nature and spirit of philosophy are considered. The relationships to other fields are examined, especially the connections with history, literature, psychology, and religion. The philosophical implications of evolution are presented; mechanistic, vitalistic, and emergent theories are explained. Such types of philosophy as idealism, realism, and pragmatism are then studied. 3 Class Hrs.; 3 Credit Hrs.

24-41 *Problems of Philosophy* — Beginning with a study of the nature of problem solving in philosophy, the course proceeds with a systematic presentation of problems in epistemology and ways of knowing, problems in the realm of values, problems of freedom and determinism, and finally problems in metaphysics. 3 Class Hrs.; 3 Credit Hrs.

24-42 *Foundations in Ethics* — Following the study of the origin and development of morality, the role of ethics in contemporary society is discussed. Psychological, biological, and cultural factors are presented. The relationships between ethics and religion are clarified. Then follows a study of the important schools of thought, such as authoritarianism, naturalism, hedonism, formalism, intuitionism, relativism, and self-realization and eclecticism. Selected problems in ethics are analyzed. 6 Class Hrs.; 3 Credit Hrs.

Psychology

25-01 *Introductory Psychology* — This course with its companion course, General Psychology (25-02), presents the major concepts from most areas of psychological investigation. In this first term the emphasis is placed upon the experimental approach to the study of behavioral data including growth and development, learning, perception and motivation. 4 Class Hrs.; 4 Credit Hrs.

25-02 *General Psychology* — Continuing the emphasis on general concepts, this course considers the sensory basis of response, individual and group differences, mental testing, attitude formation, and personal adjustment. Prep. 25-01; 4 Class Hrs.; 4 Credit Hrs.

25-04s *Social Psychology* — The relationship of man to the group; a study of his patterned social behavior, his morale, customs and myths, his social structures and institutions, and his conscious and unconscious motives and motivation. Prep. 25-02; 5 Class Hrs.; 2½ Credit Hrs.

25-06s *Psychology of Adjustment* — A beginning course devoted to problems and principles of adjustment to life. Not recommended for students who have taken other psychology courses. 5 Class Hrs.; 2½ Credit Hrs.

25-07 *Psychology* — This is an introduction to psychology. The aim is to present to engineers a broad overview of the wide and varied interests, efforts, pursuits and problems of psychology and psychologists. Among those discussed are such key problems as growth and development, motivation, individual differences, measurement, and statistical concepts, psychology of sensation and perception. Wide general reading will be required. 6 Class Hrs.; 3 Credit Hrs.

25-08 *Psychology* — A continuation of 25-07. Selected topics for discussion emphasize the psychology of group behavior, personality development and integration. Wide reading will be required. Prep. 25-07; 6 Class Hrs.; 3 Credit Hrs.

25-09 *Statistics in Psychology* — An introductory course dealing with elementary descriptive statistics, graphs, significant numbers, measures of central tendency and dispersion, types of distributions, and elementary correlation. Laboratory work in computational techniques and the use of computing machines will be included. Prep. 25-02; 4 Class Hrs.; 4 Credit Hrs.

25-10 *Statistics in Psychology* — An advanced course in which consideration is given to product moment, biserial, tetrachoric, and rank order correlation. Errors of sampling, statistical hypotheses, and tests of significance are treated with reference to experimental methods in psychology and education. Prep. 25-09; 4 Class Hrs.; 4 Credit Hrs.

25-11 *Individual Differences* — An account of the scientific principles basic to the investigation of human differences. Attention is directed to the history of the field, the techniques which have evolved, and the bearing which this field has upon the special disciplines within psychology, such as experimental, educational, clinical, measurements, and child. Prep. 25-02; 4 Class Hrs.; 4 Credit Hrs.

25-12 *Experimental Psychology* — This course emphasizes research methods and techniques for investigating the conditions of learning. Examples of topics which are covered are learning as a function of motive-incentive conditions, age, sex, kind of material, amount of material, and the mode of attack. These factors are considered in the light of current learning theory. Laboratory reports are required. Prep. 25-02; 3 Class Hrs.; 3 Lab. Hrs.; 4 Credit Hrs.

25-13 *Experimental Psychology* — This course emphasizes methodology. Topics covered in class and laboratory sessions include attention, the nature of illusions, perception of form, color, and space, and reading as a problem in perception. Laboratory reports are required. Prep. 25-02; 3 Class Hrs.; 3 Lab. Hrs.; 4 Credit Hrs.

25-14 *Experimental Psychology* — The structure and function of the sense organs. Emphasis is placed on the methods of investigating the sensory processes of vision, hearing, olfaction, taste, and the skin senses. Laboratory reports are required. Prep. 25-02; 3 Class Hrs.; 3 Lab. Hrs.; 4 Credit Hrs.

25-15 *Educational Psychology* — The introductory course in educational psychology is studied as an applied psychology in the field of education. It is intended not only for the preparation of future professional teachers, but for all those who may have an interest in the education of youth. Child development and personality, guidance, theories of learning and motivation, and basic principles of mental hygiene are special topics which are surveyed in this course. Prep. 25-02; 4 Class Hrs.; 4 Credit Hrs.

25-16 *Educational Psychology* — Problems indigenous to the concept of the school as an important aspect of the growing child's environment are considered. The course is research oriented in the sense that information on such problems is sought in the research literature. Learning, motivation, pupil adjustment, subject disability, and pupil evaluation are some of the areas explored. Prep. 25-15; 4 Class Hrs.; 4 Credit Hrs.

25-17 *Measurements* — A practical workshop course in the theory, selection, administration, scoring, and interpretation of individual intelligence tests. Each student is required to test a substantial series of subjects provided by the department. Training will be given in the Wechsler-Bellevue Scale, the Stanford-Binet, and various developmental scales. Prep. 25-09; 4 Class Hrs.; 4 Credit Hrs.

25-18 *Measurements* — An intensive workshop course in the theories underlying personality evaluation by psychometric means. Each student will be required to act as a subject for and administer a variety of personality instruments. The course will emphasize the clinical approach to the study of the individual personality. In addition to obtaining thorough familiarity with conventional questionnaires and tests in the field of personality, some introductory information concerning projective techniques is provided. Prep. 25-09; 4 Class Hrs.; 4 Credit Hrs.

25-19 *Measurements* — A workshop course in the theories underlying aptitude testing. The course will deal with objective evaluative instruments, with special emphasis upon the use of standardized testing procedures in industry. Each student will be required to act as a subject, and to administer and score a variety of tests. Prep. 25-02; 4 Class Hrs.; 4 Credit Hrs.

25-20 *Measurements* — More intensive practice under supervision with the Wechsler-Bellevue and the Binet and their alternate forms. Experience is offered with group tests of intelligence and with various other evaluative psychological instruments and techniques. Emphasis is upon the development of skill in the selection of instruments appropriate to the case. Prep. 25-17; 4 Class Hrs.; 4 Credit Hrs.

25-29 *Psychology of Personality* — A systematic study of normal personality growth. Approaches to the understanding of personality are made through a review of the physical, mental, and emotional development of the individual and of the social influences upon him. Several of the more prominent theories in the field are considered and some case material is presented. Prep. 25-02; 4 Class Hrs.; 4 Credit Hrs.

25-31 *Abnormal Psychology* — The study of personality deviants. Attention is directed to the historical development of the field with emphasis upon the development of theories of abnormal behavior and their classification, the rise of institutional care of the mentally ill, and the beginnings of humanitarian concepts of deviancy. Prep. Two Years of Psychology; 4 Class Hrs.; 4 Credit Hrs.

25-32 *Abnormal Psychology* — This course consists of systematic exploration of concepts of normality and abnormality. The etiology and dynamics of the various patterns of psychological disturbances are described and discussed. The relationship existing between psychological disturbances and the socio-cultural order are carefully defined. Prep. 25-31; 4 Class Hrs.; 4 Credit Hrs.

25-33 *Social Psychology* — A study of the psychological principles underlying human relations with emphasis upon motivation, nature and development of groups, social movements and institutions, antisocial behavior, social controls, leadership, co-operation, war, propaganda, and prejudice. In addition, the course seeks to elucidate the methods and techniques which yield trustworthy data regarding social phenomena. Prep. 25-02; 4 Class Hrs.; 4 Credit Hrs.

25-34 *Child Psychology* — An introduction to the growth and development of infants and young children. Systematic study is made of their characteristic patterns of behavior, motivations, and needs. Prep. 25-02; 4 Class Hrs.; 4 Credit Hrs.

25-35 *Industrial Psychology* — A study of the basic principles and techniques of the application of psychology to industrial efficiency and employee satisfac-

tion. The presentation is thoroughly practical and realistic, with emphasis upon psychological tools that management finds serviceable in the selection, placement and motivation of employees. Attention is paid to the role of psychological tests in choosing employees, the prevention of industrial "fatigue," the management of specific problems such as absenteeism, voluntary restriction of output, accident-proneness, alcoholism, recreation and other special problems. The role of government and union in industrial operations is taken into account. Prep. 25-02; 3 Class Hrs.; 3 Credit Hrs.

25-35a *Industrial Psychology* — A study of the application of psychological principles and techniques to the industrial situation. Emphasis is placed on such traditional areas as job analysis, time and motion work, employee evaluation, rating methods, safety, and the selection and use of psychological tests in the hiring and placement of workers. Prep. 25-02; 3 Class Hrs.; 3 Credit Hrs.

25-36 *Industrial Psychology* — An intensive course in personnel counseling and other preventive and remedial procedures for keeping the worker on the job and producing at high efficiency. Emphasis is placed upon working with the problem individual, but some attention is given to methods and techniques for dealing with problems in the group situation. Actual problems, as they have occurred in various industrial settings, are presented by films and records. Prep. 25-02; 3 Class Hrs.; 3 Credit Hrs.

25-36a *Industrial Psychology* — This course focuses on the social-psychological aspects of the industrial situation. While such topics as leadership, training, and small groups are considered, the major emphasis is upon role playing and group decision methods. Actual problems as they have occurred in various industrial settings are presented and discussed. In addition, members of the class participate in role playing and group participation demonstrations and analyses. Prep. 25-02; 4 Class Hrs.; 4 Credit Hrs.

25-37 *Adolescent Psychology* — A further systemic exploration of developing patterns of behavior in later childhood and adolescence, and their implications for adult life. The interrelationship of the adolescent with his parents, his peer groups, and with various institutions of society such as school and church are studied and discussed. Prep. 25-34; 4 Class Hrs.; 4 Credit Hrs.

25-38 *Physiological Psychology* — A survey of the pertinent physiological fact and theory oriented to the relation of neuro-anatomy and psychology. The structural and functional aspects of receptors, muscles, glands and nervous tissue (peripheral nerves, spinal cord, and brain) will be emphasized. (Permission of the instructor required.) 4 Class Hrs.; 4 Credit Hrs.

25-39 *Physiological Psychology* — A continuation of 25-38. The integrative action of the central nervous system and the problem of variability of behavior will be the main topics. Prep. 25-38; 4 Class Hrs.; 4 Credit Hrs.

25-41 *Advanced Psychology* — The current status of psychology among the sciences is considered in the light of its history. Emphasis is placed upon the period from Descartes (circa 1650) to the early 1900's and attention is directed to the philosophical and physiological antecedents of the emergence of psychology as a scientific discipline. Prep. two years of Psychology; 4 Class Hrs.; 4 Credit Hrs.

25-42 *Advanced Psychology* — A critical survey of the major schools of psychology which have influenced the development of modern psychology. Contemporary systematic trends are evaluated in the light of their historical development. Major schools or systems considered are Structuralism, Functionalism, Behaviorism, Gestalt Psychology and the Depth Psychologies. Prep. 25-41; 4 Class Hrs.; 4 Credit Hrs.

25-50 *Reading Improvement* — A course designed to assist students who wish to improve their study and reading habits. Areas to be considered will be informational concepts, reading rate, comprehension and vocabulary and study techniques. Specific exercises will be based upon consideration of the individual student's needs. 3-5 Class Hrs.; 0 Credit Hrs.

25-61, 25-62 *Directed Study* — Independent study under the direction of a member of the department. Open to above average seniors majoring in Psychology, with the approval of the chairman of the department. Credit to be arranged.

25-71, 25-72, 25-73, 25-74 *Seminar in Psychology* — Discussion of current problems in Psychology. Topics will be introduced by members of the department and by guest lecturers. 2 Class Hrs.; 1 Credit Hr. (each term).

Sociology

26-01 *Principles of Sociology* — This introductory course concerns itself with man's place in nature, his biological development from proto-human forms, the nature and meaning of racial differences, the emergence and growth of culture, and the comparison of cultural patterns in contemporary world society. Basic concepts of anthropology are stressed. 4 Class Hrs.; 4 Credit Hrs.

26-02 *Principles of Sociology* — (Continuation of 26-01) Following the study of the origin and the development of man as a biological and cultural being, the nature of man's social life is discussed. Areas to be considered are the basis of human society, the process of individual adjustment to society and the matter of numbers, spatial distribution and organization of people. In addition, social institutions are discussed with an emphasis on a structural, functional analysis of institutional life. Prep. 26-01; 4 Class Hrs.; 4 Credit Hrs.

26-07 *Social Problems* — A survey for students taking only one course in sociology. Among the problems considered are crime, racial and religious prejudice and discrimination, the physically handicapped, the family, political deviations, and natural resources. 4 Class Hrs.; 4 Credit Hrs.

26-08 *Comparative Culture* — Utilizing the concept of culture, an examination is made of the way people have developed different learned modes of adjustment to universal human situations. Anthropological material from a wide variety of cultures is drawn upon, showing how economic, political and religious behavior may be understood only in the context of a people's total environment. 4 Class Hrs.; 4 Credit Hrs.

26-09 *American Culture* — A study of modern American culture and its major social institutions: economic, religious, governmental, familial, educational,

welfare, and recreational. Consideration is also given to social classes and stratification, mobility, and individualism. The parts played by subcultures and cultural integration are also examined. Prep. 26-02; 4 Class Hrs.; 4 Credit Hrs.

26-10 *American Inter-Group Relations* — The analysis of American society and culture from the point of view of nationality and racial groups within the United States, tracing their history, development, and probable future as well as their influence on national life and their place in the world today. Consideration is also given to cultural and religious cleavages in American society and the problem of assimilation. Emphasis will be given to a few selected nationality groups, the Negro, and the American Indian. Prep. 26-02; 4 Class Hrs.; 4 Credit Hrs.

26-11 *Social Problems* — A study of the elements, processes, structures, and relationships involved in social problems and consequent public reactions. Specific subjects covered include natural resources, physical and mental health problems, alcoholism, and poverty. Prep. 26-02; 4 Class Hrs.; 4 Credit Hrs.

26-12 *The Individual and Society* — Life-history studies in the adjustment of the individual to society, dealing basically with constitutional, social, and cultural factors affecting personality development. The relationship of the individual to this group in terms of status, roles, rights, and obligations as these pertain to the critical periods in the cycle of life is also studied, as is the function of the individual in social change and the impact of social control on personal interests. Prep. 26-02; 4 Class Hrs.; 4 Credit Hrs.

26-15 *Sociology of the Family* — The family as a social institution in several selected cultures is the basic orientation of this course. The interrelations of the family and the political, economic, and educational interests are studied. The social nature of personality, change in roles, and the effects of individualism, mobility, and urbanization are emphasized. Prep. 26-02; 4 Class Hrs.; 4 Credit Hrs.

26-16 *Criminology* — A study of the patterns and evolution of criminal behavior, the social forces involved, and the development of the individual criminal. Also included is an analysis of the administration of criminal justice: law, courts, police, prisons. Local penal institutions are visited. Prep. 26-02; 4 Class Hrs.; 4 Credit Hrs.

26-17 *Urban Sociology* — A study of the modern American city based on its historical background and comparison with other cities of the world. Its types, social values, and pathological elements are discussed, as are methods of city planning. Prep. 26-02; 4 Class Hrs.; 4 Credit Hrs.

26-18 *Race and Culture Contact* — An analysis of these problems in areas of the world outside the United States, with emphasis on Latin America and present and previous colonial areas of Africa and Asia; an analysis of the cleavages in the various countries studied and the processes of assimilation. Among the areas studied will be Mexico, Brazil, British West Africa, India, and the Union of South Africa. Prep. 26-02; 4 Class Hrs.; 4 Credit Hrs.

26-19 *Sociological Theory* — A history of sociological thought from its beginning up to the early part of the 19th century. Origins, aims, and accomplishments

of the social science movement are studied. Special attention is given several of the earlier schools of sociological thought. (Primarily for senior majors.) Prep. 26-12; 4 Class Hrs.; 4 Credit Hrs.

26-20 *Sociological Theory* — Beginning with influential theorists of the early 19th century, this course deals with modern and contemporary sociological theories. The contributions of such men as Spencer, Marx, Sumner, Ward, Gumpłowicz, Durkheim, Pareto, and Thomas are studied. Prep. 26-19; 4 Class Hrs.; 4 Credit Hrs.

26-21 *Sociology of Religion* — This course deals with the bearing of religion upon the total social structure. The socio-cultural backgrounds, the motivations of religious belief and behavior, the interactions of social status, and the social psychology of religion are studied. The social creeds of organized religions in America are examined. Prep. 26-02; 4 Class Hrs.; 4 Credit Hrs.

26-22 *Principles of Social Work* — Primarily offered to students who intend to enter a school for social work upon graduation from college, this course can be helpful also to students who are considering social work as a part-time and nonprofessional interest. The various types of work and fields of specialization are presented. Representatives from local agencies give occasional lectures. Weekly field trips are assigned and reported on in class. Available only on approval by head of department. Prep. 26-12; 4 Class Hrs.; 4 Credit Hrs.

26-23 *Methods and Problems in Social Research* — A study of the theory and methods of social research with discussion of recent investigations and analysis of the methods used. Open to sociology majors in senior year with approval of department. 4 Class Hrs.; 4 Credit Hrs.

26-24 *Community Organization and Analysis* — Development of the concept of community in relation to physical environment, membership population, and social institutions. The structure and function of communities and their component parts. Relations between communities and such broader entities as regions, political units, bureaucratic structures. Contrasts among communities in highly industrialized and in underdeveloped areas. Emphasis on community social action programs. 4 Class Hrs.; 4 Credit Hrs.

26-56 *Physical Anthropology* — A survey of the races of mankind: a consideration of the extinct and living varieties, together with an analysis of their relationships, classifications, and distribution over the world in the past and the present. 3 Class Hrs.; 3 Credit Hrs.

26-57 *Cultural Anthropology* — Introduction to contemporary primitive peoples: cultural patterns, diffusion, and functions. Consideration of modal personality and deviants as reflected in primitive cultures. Analysis of the cultural diversity of contemporary social groups. 3 Class Hrs.; 3 Credit Hrs.

26-61, 62 *Directed Study* — Independent work under the direction of members of the department upon a chosen topic. Limited to qualified seniors preparing in Sociology with approval of department. 4 Credit Hrs. (each term).

26-71 *Seminar* — Contemporary sociological theory is studied with special emphasis given each term to a selected school of thought. 2 Class Hrs.; 2 Credit Hrs.

26-72 *Seminar* — A study of the causative factors of tensions between ethnic and religious groups in contemporary American society. Presupposes adequate knowledge of pertinent principles of social psychology. Several existing programs for constructive action are evaluated. 2 Class Hrs.; 2 Credit Hrs.

Art

27-01 *Ancient Art* — Beginning with a study of the materials and techniques employed by ancient artisans in architecture, sculpture and painting, this course includes a survey of prehistoric art and the arts of ancient Egypt, Mesopotamia, Crete, and Greece. Lectures are illustrated with lantern slides and include brief historical accounts of each period under discussion. 4 Class Hrs.; 4 Credit Hrs.

27-02 *Early Christian and Medieval Art* — This course is a continuation of 27-01, *Ancient Art*, although the latter is not a prerequisite course. Beginning with Roman art, this course includes a study of Early Christian and Byzantine art, Romanesque and Gothic art. 4 Class Hrs.; 4 Credit Hrs.

27-03 *Italian Renaissance Art* — This course is a continuation of 27-02, *Early Christian and Medieval Art*, although the latter is not a prerequisite course. Beginning with a survey of Renaissance architecture and sculpture, the course then concentrates on a study of Italian Renaissance painting. Lectures are illustrated with drawings and lantern slides and include detailed discussions on the materials, techniques, design and composition employed by various artists. 4 Class Hrs.; 4 Credit Hrs.

27-04 *European Art* — A continuation of Course 27-03, this course begins with the Baroque period of art and continues with a survey of Renaissance Art in Northern, Western and Eastern Europe and includes a study of architecture, sculpture, painting and graphic arts up to the end of the nineteenth century. Emphasis is placed upon the contributions of Hubert and Jan Van Eyck, Durer, Bruegel, Rubens, El Greco, Goya, Rembrandt, Turner, Reynolds and the French Impressionists. Lantern slides and museum visits supplement the lectures. 4 Class Hrs.; 4 Credit Hrs.

27-08 *American Art I* — A study of the development of American art from colonial times to about 1860. The object of this course is to acquaint the student with the rise of architecture, sculpture, and painting in America. Lectures include discussion of techniques, styles, methods, and materials employed during the periods considered. Lantern slides and visits to local museums supplement the lectures. 4 Class Hrs.; 4 Credit Hrs.

27-09 *American Art II* — A continuation of Course 27-08, this course begins with the Civil War Period and includes a study of American architecture, sculpture, and painting, up to the present. Particular attention is given to the work of Henry Hobson Richardson, Louis Henry Sullivan, and Frank Lloyd Wright. Lantern slides and museum visits augment the lecture material. 4 Class Hrs.; 4 Credit Hrs.

27-11 *History of Civilization* — This course is designed to cultivate a knowledge and appreciation of the cultures of ancient times. Beginning with a study of the

early world and prehistoric man, it includes a study of the ancient civilizations of Egypt, Sumer, Assyria, Chaldea, Persia, Phoenicia, Palestine, the Aegean World, and the influence of Oriental philosophies on the West. 4 Class Hrs.; 4 Credit Hrs.

27-12 History of Civilization — This course is a continuation of 27-11, *History of Civilization*. Beginning with a study of the migrating Greek tribes, the course includes an analysis of the Greek city-states, the development of democratic thought, Greek governmental theories, Greek art, architecture, science, and philosophy. The course concludes with a survey of the Hellenistic world, the rise of Rome, and the growth of the Roman Empire. Prep. 27-11; 4 Class Hrs.; 4 Credit Hrs.

27-13 History of Civilization — This course is a continuation of 27-12, *History of Civilization*. It includes a study of the organization and development of the Early Christian Church, Early Christian and Byzantine art and architecture, the Mohammedan World, the European Feudal Age, and the Christian Crusades. Prep. 27-12; 4 Class Hrs.; 4 Credit Hrs.

27-14 History of Civilization — This course is a continuation of 27-13, *History of Civilization*. Beginning with a study of the art of the Romanesque and Gothic periods, it includes a study of the rise of European nations, the Italian and European Renaissance periods, the Religious Revolt, and the Age of Discovery and Exploration. Prep. 27-13; 4 Class Hrs.; 2 Credit Hrs.

27-30 Elementary Drawing and Lettering — An introductory study of mechanical drawing and lettering, this course is designed to provide fundamental training upon which other applied art courses may be built. The work of the course includes practice in the use of drawing instruments, Gothic, Roman, and Script lettering, elementary mechanical drawing problems, and tracings in ink. 2 Class Hrs.; 4 Lab. Hrs.; 4 Credit Hrs.

27-31 Pictorial Drawing — A continuation of Course 27-30 which is a prerequisite, this course includes studies in isometric drawing, oblique and cabinet drawing, and problems in mechanical perspective. The course concludes with some practical applications of each in the field of art and industry. Prep. 27-30; 2 Class Hrs.; 4 Lab. Hrs.; 4 Credit Hrs.

27-32 Creative Drawing — This course is a detailed study of drawing materials and techniques. The student will execute creative drawing problems in pen and ink, pencil, charcoal, crayon and chalk, that will offer experience in drawing form and texture. Emphasis is placed on solving drawing problems in black and white for commercial design such as book illustration and magazine illustration. 6 Lab. Hrs.; 4 Credit Hrs.

27-33 Theory of Color and Design I — This course is a concentrated study of the techniques and theories of design and composition in commercial art and creative painting, including a detailed study of the theory and color. The student will execute color compositions, including practice and instruction in water color and chalk. 6 Lab. Hrs.; 4 Credit Hrs.

27-34 Theory of Color and Design II — A continuation of Course 27-33 which is a prerequisite. In this course the student will concentrate on designing with

color such problems as landscape and still life painting, costume figure composition, and illustration including book jacket design and portraiture. Prep. 27-33; 6 Lab. Hrs.; 4 Credit Hrs.

27-35 *Oil Painting* — A continuation of 27-34, this course concentrates on the modes and techniques of oil painting. The work of the course includes paintings of still life, landscape, and portraiture by local museums. 6 Lab. Hrs.; 4 Credit Hrs.

27-36 *Graphic Arts — Woodcuts* — This course is a detailed study and execution of the techniques of creating woodcut prints. The student will execute black and white and color prints. The graphic work of various artists such as Durer, Holbein, and Lucas Cranach is studied in detail. 6 Lab. Hrs.; 4 Credit Hrs.

27-37 *Graphic Arts — Silk Screen* — This course is an applied art course in the technique of silk screen printing. The student will execute in color silk screen prints. The silk screen work of various contemporary artists is studied in detail. 6 Lab. Hrs.; 4 Credit Hrs.

27-40 *Ancient Art and Architecture* — Beginning with a study of prehistoric art, this course includes a survey of the art of Egypt, Mesopotamia, Greece, Rome, the Early Christian, and the Byzantine periods. The course consists of approximately twenty-five one-hour lectures, a majority of which are illustrated with lantern slides and board drawings.

Although an emphasis is placed upon architecture, some lectures are devoted to sculpture and to painting in their relationships to architectural decoration. 3 Class Hrs.; 3 Credit Hrs.

27-41 *Medieval and Renaissance Art and Architecture* — A continuation of 27-40 *Ancient Art and Architecture*, this course begins with a study of Christian symbolism and a survey of Romanesque and Gothic art with particular emphasis upon architecture and sculpture. It continues with the contributions of Renaissance architects: Brunelleschi, Michelozzo, Alberti, Lombardo, Michelangelo, and Palladio, and the sculptors Ghiberti, Donatello, Verrocchio, and Michelangelo.

A majority of the lectures in this course are illustrated with lantern slides and board drawings. 3 Class Hrs.; 3 Credit Hrs.

27-42 *Renaissance and Modern Art and Architecture* — This course is a continuation of 27-41 *Medieval and Renaissance Art and Architecture*. Beginning with a study of Renaissance painting, the course continues with a survey of the architectural developments in Europe and America from the Baroque period to contemporary times. Lectures are augmented with lantern slides and board drawings. 6 Class Hrs.; 3 Credit Hrs.

Music

28-01 *Music Appreciation* — The principal concern of this course is teaching the student a technique for listening to music creatively. Representative works from the standard repertory are analyzed with emphasis on listening to music actively. 4 Class Hrs.; 4 Credit Hrs.

28-03 *Music Fundamentals* — Basic facts concerning tone relationships, music notation, and elementary chord structure are the subject matter of this course. Class sessions are devoted to sight-singing and ear training. 4 Class Hrs.; 4 Credit Hrs.

28-04 *Musical Forms* — The more common musical forms such as the sonata, theme and variations and rondo are discussed and analyzed. Examples from the standard repertory are played in class and assigned as outside listening. Emphasis is placed on hearing the formal structure of the composition. Prep. 28-01; 4 Class Hrs.; 4 Credit Hrs.

28-05 *The Classical Symphony* — Structural development of the symphonic form during the classical period is emphasized. The most significant symphonies of Haydn, Mozart and Beethoven are used as the basis of discussion. Prep. 28-01, 28-03; 4 Class Hrs.; 4 Credit Hrs.

28-06 *The Classical Opera* — A survey course in which operatic forms and developments are traced, with particular attention to the opera forms of Haydn and Mozart. The student will study in detail Haydn's "Orfeo," Mozart's "Don Giovanni," "The Marriage of Figaro," "The Magic Flute," and "Cosi Fan Tutti" as well as one example of the *commedia dell'arte*, Rossini's "The Barber of Seville." The student will be required to listen to other works outside of class. 4 Class Hrs.; 4 Credit Hrs.

28-12 *Music Masterpieces Before 1750* — This is a course designed to acquaint the student with each important musical development from the plain chant era through the Baroque. The student follows recordings of the various works from individual scores. Outside listening required. 5 Class Hrs.; 2½ Credit Hrs.

28-14 *Music in the Romantic Era* — Representative score by such composers as Schubert, Schumann, Berlioz, Chopin, and Wagner will be analyzed in detail to follow the development of the Romantic Movement in music. Special attention will be given to the growth of harmonic resources, the extension of musical forms, and the increasingly personal expressiveness of 19th century music. 4 Class Hrs.; 4 Credit Hrs.

28-15 *Chamber Music* — From duets to octets, from Mozart to Milhaud, this survey will cover scores of some of the most intensive and serious creations in the mainstream of Western Music. Prep. 28-01; 4 Class Hrs.; 4 Credit Hrs.

28-20 *American Music* — This course examines the development and emergence of an "American" school in composition. Though it centers mainly about the twentieth century, antecedents such as folk music will be included in the course of study. Prep. 28-01; 4 Class Hrs.; 4 Credit Hrs.

28-40 *Introduction to Music* — This course is designed to acquaint the student with such fundamentals as major and minor scales and basic chord relationships. Melody, harmony, counterpoint, and rhythm will be analyzed. Basic forms of musical composition comprise the second half of the course. 3 Class Hrs.; 3 Credit Hrs.

28-41 *Musical Forms* — A study of such forms as the fugue, the sonata, theme and variations, and the lied paves the way for a detailed analysis of the symphony, the string quartet, the opera, and the oratorio. Special emphasis is placed

on active listening. Examples will be drawn principally from the Classical and Baroque periods. 3 Class Hrs.; 3 Credit Hrs.

28-42 *Contemporary Music* — This course is designed to bridge the gap between listener and composer in the 20th century. A study of the special styles of composition such as the 12-tone technique, the neo-classic, the neo-romantic, and the impressionistic forms the basis of inquiry. Special attention is given to American composers. 6 Class Hrs.; 3 Credit Hrs.

Speech and Drama

29-01 *Public Speaking* — The study and practice of the basic principles and techniques of effective modern speaking. The class is organized as a functional group. Emphasis is on conversational delivery and clear, concise composition. Group procedures, impromptu speaking, and the handling of short expository forms are practiced. The course trains for the communication requirements of everyday business, professional, and social life. 4 Class Hrs.; 4 Credit Hrs.

29-02 *Public Speaking* — A continuation of 29-01 with emphasis upon speech patterns which involve effective discussion, the study of fundamental issues, analysis, evidence, and reasoning as factors in convincing and persuading people. Prep. 29-01; 4 Class Hrs.; 4 Credit Hrs.

29-03 *Effective Speaking* — A short practical course designed for engineers. The fundamentals of speaking, conferring and reporting are studied and practiced. The class is organized as a functional group with officers and agenda. Theory is minimized; practice emphasized. 6 Class Hrs.; 3 Credit Hrs.; (5-week term); 3 Class Hrs.; 3 Credit Hrs.; (10-week term).

29-11 *Comparative Drama* — A survey of the development of the theatre and the drama and the relation of both to each other and to philosophical thinking as seen by studying scripts written by major dramatists of the Western World. This course will concern itself with the theatre and the drama of Greece and Rome, medieval Europe, Elizabethan and Restoration England, and seventeenth century France. 4 Class Hrs.; 4 Credit Hrs.

29-12 *Comparative Drama* — A continuation of 29-11. This course will concern itself with the growth and development of the proscenium theatre, the emphasis upon naturalistic and realistic presentation, the theatre innovations of the twentieth century. Major European and American dramatic scripts of the eighteenth, nineteenth and twentieth centuries will be studied and analyzed so that students will understand the relationships of theatre architecture, the arts of the playwright and other creative artists, and the philosophical thinking of the times. 4 Class Hrs.; 4 Credit Hrs.

29-17 *An Introduction to the Theatre Arts* — A study of the aesthetics of the theatre. An analysis of the nature and functions of dramatic composition and presentation. This course will aim at developing a basis for judging dramatic productions and will approach theatre from the point-of-view of the spectator. Students will be required to evaluate actual stage, radio, and television plays. 4 Class Hrs.; 4 Credit Hrs.

29-18 *Drama Criticism* — A study of dramatic criticism from Aristotle to the present. A study of the growth and development of the drama as seen through the criticism of plays and presentations. A major topic to be considered will be the role of the contemporary play reviewer. 4 Class Hrs.; 4 Credit Hrs.

29-21 *Play Production* — A course dealing with the principles which underlie theatre practice and theatre technique — selecting the play; analyzing the script; determining the style of production; designing the floor plan and the setting; planning the stage movement; designing the properties, the costumes, the make-up, the lighting; coordinating the work of the production staff; planning the budget. Students enrolled in this course will prepare a play for production by working out a detailed Director's Prompt Book. 4 Class Hrs.; 4 Credit Hrs.

29-22 *Rehearsal and Performance* — A course dealing with the practical application of the theories studied in *Play Production* and concentrating upon the role of the director in fusing the talents of the artists and craftsmen involved in the production process. The function of the director, the director's relationship with his associates, the conduct of rehearsals, the purpose and methods of acting, the conduct of performance, and the evaluation of performance. Students enrolled in this course will engage actively in the mounting of a play for production. Prep. 29-21; 4 Class Hrs.; 4 Credit Hrs.

English

30-01 *English* — A review of basic sentence structure, punctuation, and principles of paragraphing. Theme assignments are planned to develop practical skill in the expository forms. Essays and a novel are studied for comprehension, analysis, and vocabulary development. 3 Class Hrs.; 3 Credit Hrs.

30-02 *English* — A study of the structure, organization, and preparation of student reports: outlining, summarizing, research techniques, evaluation, and argumentation. Experimental work in each of these phases is carried out by means of theme assignments. The course includes assigned readings and a novel. Prep. 30-01; 3 Class Hrs.; 3 Credit Hrs.

30-03 *English* — A study of the problems peculiar to description and narration. Theme work in the course, in addition to these basic types, includes the writing of business letters and a literary critique. The course includes assigned readings and a novel. Prep. 30-02; 3 Class Hrs.; 3 Credit Hrs.

30-04 *Introduction to Literature* — A study of the aims and techniques of various common types of literature: the play, the short story, lyrical and narrative poetry, and the literary essay. Instructional methods include assigned reading and writing of short critical reports. 5 Class Hrs.; 2½ Credit Hrs.

30-09 *Report Writing* — The study and practice of the principles and skills involved in planning, writing, and delivering modern reports. Achievement of purpose, format, organization, content, style, and documentation are principal targets of achievement. 3 Class Hrs.; 3 Credit Hrs.

30-15 *Literature* — Five Shakespearean plays are read and discussed with special attention to character, motivation, situation, and adaption to the Elizabethan stage. 3 Class Hrs.; 3 Credit Hrs.

30-16 *American Literature* — A survey of outstanding works in American literature, in their relation to social and intellectual backgrounds. 6 Class Hrs.; 3 Credit Hrs.

30-17 *Literature* — A course consisting of a careful study of five of Shakespeare's plays. The purpose of the course is twofold: to awaken an interest in and an appreciation of literature, and to develop in the student effective reading habits which will be serviceable to him in any reading he may do hereafter. 3 Class Hrs.; 3 Credit Hrs.

30-18 *Literature* — A course which parallels 30-17 in purpose and method, treats four nineteenth century American novels and develops in students the ability to judge whether the author has been accurate in observation, skillful in expression, and sound in ethical implication. 3 Class Hrs.; 3 Credit Hrs.

30-19 *Shakespeare Plays* — A reading course in Shakespeare open to all upper-class students. Five plays not included in 30-15, 30-17, 30-61 or 30-62 are studied and discussed in class with emphasis on character, story, and significance to modern readers. 5 Class Hrs.; 2½ Credit Hrs.

30-21 *Intermediate Writing* — A practice course in the writing of the shorter forms of composition. Each student will be given considerable latitude in writing in the field of his individual interest. Student manuscripts will be read and analyzed in class. 4 Class Hrs.; 4 Credit Hrs.

30-22 *Intermediate Writing* — A continuation of 30-21. Approximately a quarter of the work assigned consists of preliminary analysis and completion of a short story for each student on a given conflict problem. Prep. 30-21; 4 Class Hrs.; 4 Credit Hrs.

30-23 *Advanced Composition* — A course designed to meet the needs of advanced students who are interested in literary composition and who have proved their ability in 30-22 Intermediate Writing. 4 Class Hrs.; 4 Credit Hrs.

30-24 *Advanced Composition* — A continuation of 30-23. As in the previous course, class instruction will be supplemented by individual conferences with the instructor. Special attention will be given to the preparation of manuscripts for publication. 4 Class Hrs.; 4 Credit Hrs.

30-29 *Foundations of the English Language* — The development of English from and alongside other languages; cognates and derivatives. Application of some of the principles of linguistic science, including phonetics and phonology, to an understanding of many of the phenomena of change in English words. 4 Class Hrs.; 4 Credit Hrs.

30-30 *Foundations of the English Language* — A continued treatment of the principles involved in 30-29, with considerable attention to the influence of accent. An examination of English in its larger elements, and of the informative and symbolic uses of it, with some of the implications of semantics. Prep. 30-29; 4 Class Hrs.; 4 Credit Hrs.

30-31 *Western World Literature* — A survey of the principal writings of the classic period, including the principal Greek and Latin authors from Homer to Lucian, and passages from the Bible. Attention is given to literary force, content, and historical setting. 4 Class Hrs.; 4 Credit Hrs.

30-32 *Western World Literature* — A continuation of 30-31. Included in the readings are literary masterpieces of England, France, Germany, Norway, Spain, Italy, and Russia. 4 Class Hrs.; 4 Credit Hrs.

30-33 *Survey of English Literature* — A survey of English literature to 1800. After a brief study of the social and political background of each literary period, the writing of the period is considered, and the more important writers are studied and read in detail. The purpose of the course is to give the student an appreciation of English literature as a whole, and an intimate knowledge of its major figures. 4 Class Hrs.; 4 Credit Hrs.

30-34 *Survey of English Literature* — A survey of English literature from 1800 to the present century. The outstanding writers are read, studied, and related to the general background of nineteenth century England. The purpose of the course is to give the student an understanding of the writers who contributed most to the formation and development of modern literature in England. 4 Class Hrs.; 4 Credit Hrs.

30-35 *American Literature to 1860* — A survey of American literature from colonial times to the triumph of the transcendental movement in New England. The work of Bryant, Irving, Cooper, Poe, Emerson, Thoreau, Lowell, Holmes, Longfellow, and Melville will be emphasized. 4 Class Hrs.; 4 Credit Hrs.

30-36 *American Literature after 1860* — Continuing 30-35, the course will consider the rise of realism after the Civil War, the development of American humor, the appearance of local color writers, and modern trends since 1900. Prep. 30-35; 4 Class Hrs.; 4 Credit Hrs.

30-37 *Nineteenth Century Poetry* — A basic course in the nature and understanding of poetry. The poetry of Wordsworth, Coleridge, Shelley, Keats and Byron will be studied against the background of romanticism. Their poetic theories and practices will be weighed and evaluated. 4 Class Hrs.; 4 Credit Hrs.

30-38 *Nineteenth Century Poetry* — A continuation of 30-37. The Victorian poets, especially Tennyson and Browning, will be studied for their significance and importance in the development of poetry. 4 Class Hrs.; 4 Credit Hrs.

30-40 *Classical and Biblical Literature* — The first unit of a great-books sequence. A study of standard works of antiquity, chiefly those which continue today in popular favor. Each of the four or five works assigned will be examined as to meaning, tone, and historical context. 3 Class Hrs.; 3 Credit Hrs.

30-41 *European Literature* — The second unit of a great-books sequence. In this term will be studied five or six European works of lasting importance, affording a variety of literary types, historical periods, and national origins. 3 Class Hrs.; 3 Credit Hrs.

30-42 *Masterpieces of England and America* — The third unit of a great-books course. Study will be made of complete works too long to be considered effectively in survey courses. While understanding and appreciation of text will be the main objective of the course, attention will be given also to historical and biographical background. 6 Class Hrs.; 3 Credit Hrs.

30-43 *Nineteenth Century Prose* — An examination of significant prose writers of the early nineteenth century in England and their relation to the social, political, and literary currents of the time, with consideration of background figures like Godwin and Cobbett, the establishment of the great quarterlies and the literary magazines, the Romantic critics and essayists, Coleridge, Lamb, Hazlitt, and DeQuincey, and such transitional writers as Carlyle and Macaulay. 4 Class Hrs.; 4 Credit Hrs.

30-44 *Nineteenth Century Prose* — A continuation of 30-43. Examination of the major prose writers of Victorian England in the works of Thackeray, Newman, Ruskin, Arnold, Huxley, Pater, and Stevenson. 4 Class Hrs.; 4 Credit Hrs.

30-45 *Great English Novels of the Nineteenth Century* — An appreciative and critical study of representative works of great English novelists of the nineteenth century. Emphasized in the first term are Scott, Jane Austen, Emily Brontë, Dickens, and Thackeray. 4 Class Hrs.; 4 Credit Hrs.

30-46 *Great English Novels of the Nineteenth Century* — A continuation of 30-45 with concentration on George Eliot, Meredith, Hardy, Trollope, and Conrad. 4 Class Hrs.; 4 Credit Hrs.

30-47 *The Modern Novel* — A study of some of the outstanding novels of the twentieth century, with emphasis on the social outlook they imply. 4 Class Hrs.; 4 Credit Hrs.

30-48 *The Modern Drama* — A study of native and European drama since 1900, with emphasis on the relationship between drama and history in the twentieth century. 4 Class Hrs.; 4 Credit Hrs.

30-50 *Representative Novels* — The class will read and discuss several of the most significant novels from the time of Richardson and Fielding to the present. The works assigned in this course are so chosen as to show the evolution of the novel during the past two hundred years. 5 Class Hrs.; 2½ Credit Hrs.

30-51 *Introduction to Journalism* — This course treats the functions of the editorial department and the general tasks of an "inside" man. The student is given extensive practice in the rewriting of news stories. 4 Class Hrs.; 4 Credit Hrs.

30-52 *Introduction to Journalism* — The problems of reporting and news-writing, with written assignments in all types of spot news reporting. Prep. 30-51; 4 Class Hrs.; 4 Credit Hrs.

30-53 *Techniques of Journalism* — Editing the news. The writing of editorials, feature articles, and columns. Prep. 30-52; 4 Class Hrs.; 4 Credit Hrs.

30-54 *Techniques of Journalism* — A general practice course in newspaper writing, the covering of special assignments, and editorial problems. Prep. 30-53; 4 Class Hrs.; 4 Credit Hrs.

30-55 *Vocabulary Building* — This course is concerned mainly with the Greek, Latin, and Germanic elements from which modern English words are made. It includes also some work in the history of the language and types of semantic change. 3 Class Hrs.; 3 Credit Hrs.

30-57 *Introduction to Semantics* — A study of the ways in which language habits affect thinking processes and raise problems in social relationships. 3 Class Hrs.; 3 Credit Hrs.

30-58 *Discussion and Debate* — Practice in the round-table and panel discussion and in intercollegiate type of debate. A study of the techniques of reasoning based upon logic, semantics, and the modern scientific method. 3 Class Hrs.; 3 Credit Hrs.

30-61 *Shakespeare* — The Elizabethan period, sixteenth century London, the Shakespearean stage and audience, and the actors' companies will be discussed. Shakespeare's life and his development as a dramatist will be carefully considered. Five plays will be intensively studied. 4 Class Hrs.; 4 Credit Hrs.

30-62 *Shakespeare* -- Lectures will be given on Shakespeare's language, the text of the plays, Shakespearean criticism, editors' problems, etc. Four plays will be intensively studied. The sonnets will be read and discussed. Prep. 30-61; 4 Class Hrs.; 4 Credit Hrs.

30-63 *Chaucer* — A study of the *Canterbury Tales*, with careful attention to Middle English vocabulary, historical setting, and the rhythms and devices of Chaucer's poetry. Included in the readings are the General Prologue and seven Tales, with links and prologues. 4 Class Hrs.; 4 Credit Hrs.

30-64 *Chaucer* — This course is principally concerned with *Troilus and Criseyde*, *The House of Fame*, *The Parliament of Fowls* and certain selected parts of *Boece*. Prep. 30-63; 4 Class Hrs.; 4 Credit Hrs.

30-66 *Eugene O'Neill* — A comprehensive course tracing the development of Eugene O'Neill as a playwright and showing the influence of Eugene O'Neill in World Drama. Eugene O'Neill will be evaluated as a writer of tragedy, as a naturalist, and as an experimenter. 5 Class Hrs.; 2½ Credit Hrs.

30-70 *Eighteenth Century English Literature* — A study of the work and techniques of the principal writers in the first half of the century. 4 Class Hrs.; 4 Credit Hrs.

30-71 *Eighteenth Century English Literature* — Similar in its method to 30-70 but dealing with the literary production from 1750-1800. Emphasis will be on the motivation and techniques of the pre-Romantics. 4 Class Hrs.; 4 Credit Hrs.

French

31-01 *Elementary French* — A beginner's course stressing the essentials of grammar, practice in pronunciation, and progressive acquisition of a basic vocabulary and idiomatic expressions. 3 Class Hrs.; 3 Credit Hrs.

31-02 *Elementary French* — A continuation of 31-01, with emphasis on the more difficult points of grammar, particularly the uses of the subjunctive mood. Prep. 31-01; 3 Class Hrs.; 3 Credit Hrs.

31-03 *Elementary French* — A continuation of 31-02. Reading of simple French prose, with written and oral exercises based on the material read. French conversation is encouraged whenever feasible. Prep. 31-02; 3 Class Hrs.; 3 Credit Hrs.

31-04 *Elementary French* — A continuation of 31-03. Reading of French prose of moderate difficulty, with practice in conversation. Prep. 31-03; 3 Class Hrs.; 1½ Credit Hrs.

31-11 *Introduction to French Literature* — An intermediate course intended for Freshmen who have had two or three years of high school French. A review of grammar with practice in composition and conversation. 3 Class Hrs.; 3 Credit Hrs.

31-12 *Introduction to French Literature* — A continuation of 31-11, using a history of French civilization as a basis for discussion and conversation. Prep. 31-11; 3 Class Hrs.; 3 Credit Hrs.

31-13 *Introduction to French Literature* — A continuation of 31-12, including intensive reading of modern prose, with emphasis on the acquisition of a reading knowledge. Conversational practice based on the reading. Prep. 31-12; 3 Class Hrs.; 3 Credit Hrs.

31-14 *Introduction to French Literature* — A continuation of 31-13, with additional reading and conversation. Prep. 31-13; 3 Class Hrs.; 1½ Credit Hrs.

31-15 *Intermediate French* — Introduction to the history of French civilization through texts of average difficulty, with some attention given to review of grammar, and to written and oral exercises. Prep. 31-04; 4 Class Hrs.; 4 Credit Hrs.

31-16 *Intermediate French* — A continuation of 31-15. Intensive reading of modern prose, with emphasis on the acquisition of a reading knowledge. Some conversational practice is included. Prep. 31-15; 4 Class Hrs.; 4 Credit Hrs.

31-17 *French Composition and Conversation* — Although some grammar review and written work is required, this course aims primarily to develop the ability to engage in French conversation. Prep. 31-16; 4 Class Hrs.; 4 Credit Hrs.

31-18 *French Composition and Conversation* — A continuation of 31-17, with emphasis on free composition, both written and oral. Oral reports serve as bases for class discussions. Prep. 31-17; 4 Class Hrs.; 4 Credit Hrs.

31-19 *Readings from Contemporary French* — In this course selected passages are read from the narrative and dramatic prose of the last fifty years. Among the writers included are Colette, Duhamel, Renard, Rolland, Vildrac, Anatole France, Gide, Proust, Romain and Sartre. Prep. 31-16; 5 Class Hrs.; 2½ Credit Hrs.

31-21 *French Literature from 1850 to 1900* — A study of the novel, especially of Flaubert, Zola, Daudet. Loti and Huysmans. Selections are read also from

Sainte-Beuve, Taine and Renan. Lectures, collateral reading and reports. Prep. 31-16; 4 Class Hrs.; 4 Credit Hrs.

31-22 *French Literature from 1850 to 1900* — A continuation of 31-21. A study of the lyric poetry of the Parnassian and Symbolist schools, with selections from Gautier, Banville, Leconte de Lisle, Hérédia, Sully-Prudhomme, Baudelaire, Verlaine, Mallarmé and Rimbeau. Plays of the period are assigned for outside reading. Lectures and reports. Prep. 31-16; 4 Class Hrs.; 4 Credit Hrs.

31-23 *French Classicism* — A study of the background and non-dramatic literature of the seventeenth century. The selections read are mainly from Malherbe, Descartes, Pascal, La Fontaine, Mme. de Sévigné, Mme. de La Fayette, Bossuet, and Fénelon. Lectures, collateral reading and reports. Prep. 31-16; 4 Class Hrs.; 4 Credit Hrs.

31-24 *French Classicism* — A continuation of 31-23. After an examination of the dramatic theories as expounded especially by Boileau, this course is devoted to the study of the plays of Corneille, Molière, and Racine. Lectures, collateral reading. Prep. 31-16; 4 Class Hrs.; 4 Credit Hrs.

31-25 *French Romanticism* — A study of the origins and development of the Romantic movement in France. Selected poems by Lamartine, Hugo, Musset and Vigny are read and discussed in class, while characteristic Romantic prose is assigned for outside reading. Lectures and reports. Prep. 31-16; 4 Class Hrs.; 4 Credit Hrs.

31-26 *French Romanticism* — A continuation of 31-25. After an examination of the dramatic theories expounded in the *Préface de Cromwell*, this course is devoted to the study of Romantic dramas. Lectures, collateral reading and reports. Prep. 31-16; 4 Class Hrs.; 4 Credit Hrs.

German

32-01 *Elementary German* — A beginner's course stressing the essentials of grammar, practice in pronunciation, and the acquisition of a basic vocabulary and idiomatic expressions. 3 Class Hrs.; 3 Credit Hrs.

32-02 *Elementary German* — A continuation of 32-01, with emphasis on the more difficult points of grammar, particularly the uses of the subjunctive mood. Prep. 32-01; 3 Class Hrs.; 3 Credit Hrs.

32-03 *Elementary German* — A continuation of 32-02. Reading of simple German prose, with oral and written exercises based on the material read. German conversation is encouraged whenever feasible. Prep. 32-02; 3 Class Hrs.; 3 Credit Hrs.

32-04 *Elementary German* — A continuation of 32-03. Reading of German prose of moderate difficulty, with practice in conversation. Prep. 32-03; 3 Class Hrs.; 1½ Credit Hrs.

32-15 *Intermediate German* — Introduction to the history of German civilization through texts of average difficulty with some attention given to review of grammar and to written and oral exercises. Prep. 32-04; 4 Class Hrs.; 4 Credit Hrs.

32-16 *Intermediate German* — A continuation of 32-15. Intensive reading of modern prose, with emphasis on the acquisition of a reading knowledge. Some conversational practice is included. Prep. 32-15; 4 Class Hrs.; 4 Credit Hrs.

32-17 *German Composition and Conversation* — Although some grammar review and written work is required, this course aims primarily to develop the ability to engage in German conversation. Prep. 32-16; 4 Class Hrs.; 4 Credit Hrs.

32-18 *German Composition and Conversation* — A continuation of 32-17, with emphasis on free composition, both written and oral. Oral reports serve as bases for class discussions. Prep. 32-17; 4 Class Hrs.; 4 Credit Hrs.

32-19 *Scientific German* — The purpose of this course is to provide students with a reading knowledge of scientific German. Articles dealing with chemistry, physics, mathematics and biology are read. Prep. 32-16; 5 Class Hrs.; 2½ Credit Hrs.

32-21 *Modern German Literature* — A survey of the main currents of German literature since 1880. The course deals chiefly with the novel and short story of the leading authors of the period. Lectures, collateral reading and reports. Prep. 32-16; 4 Class Hrs.; 4 Credit Hrs.

32-22 *Modern German Literature* — A continuation of 32-21, with the main emphasis on the drama and poetry. Representative selections from the Naturalistic, Impressionistic, and Expressionistic movements are read. Lectures, collateral reading and reports. Prep. 32-16; 4 Class Hrs.; 4 Credit Hrs.

32-23 *The Classical Period of German Literature* — This course traces the development of German literature during the second half of the eighteenth century, dealing especially with the works of Lessing and Schiller. The Storm and Stress period also receives attention. Lectures, collateral reading and reports. Prep. 32-16; 4 Class Hrs.; 4 Credit Hrs.

32-24 *The Classical Period of German Literature* — A continuation of 32-23, this course is devoted to the life and works of Goethe, with emphasis on his lyric and dramatic poetry. Lectures, collateral reading and reports. Prep. 32-16; 4 Class Hrs.; 4 Credit Hrs.

32-25 *German Literature of the Nineteenth Century* — This course traces the chief tendencies in German literature from the beginning of Romanticism to the coming of Naturalism. Representative prose works of the principal writers of the period are read. Lectures, collateral reading and reports. Prep. 32-16; 4 Class Hrs.; 4 Credit Hrs.

32-26 *German Literature of the Nineteenth Century* — A continuation of 32-25, stressing the drama and poetry of the period. The selections read are mainly from Kleist, Hölderlin, Eichendorff, Novalis, Heine, and Hebbel. Lectures, collateral reading and reports. Prep. 32-16; 4 Class Hrs.; 4 Credit Hrs.

Spanish

33-01 *Elementary Spanish* — A beginner's course stressing the essentials of grammar, practice in pronunciation and progressive acquisition of basic vocabulary and idiomatic expressions. 3 Class Hrs.; 3 Credit Hrs.

33-02 *Elementary Spanish* — A continuation of 33-01, with emphasis on the more difficult points of grammar, particularly the uses of the subjunctive mood. Prep. 33-01; 3 Class Hrs.; 3 Credit Hrs.

33-03 *Elementary Spanish* — A continuation of 33-02. Reading of simple Spanish prose, with written and oral exercises based on the material read. Spanish conversation is encouraged whenever feasible. Prep. 33-02; 3 Class Hrs.; 3 Credit Hrs.

33-04 *Elementary Spanish* — Reading of Spanish prose of moderate difficulty, with practice in conversation. Prep. 33-03; 3 Class Hrs.; 1½ Credit Hrs.

33-15 *Intermediate Spanish* — Introduction to the history of Spanish civilization through texts of average difficulty, with some attention given to review of grammar and to written and oral exercises. Prep. 33-04; 4 Class Hrs.; 4 Credit Hrs.

33-16 *Intermediate Spanish* — A continuation of 33-15. Intensive reading of modern prose, with emphasis on the acquisition of a reading knowledge. Some conversational practice is included. Prep. 33-15; 4 Class Hrs.; 4 Credit Hrs.

33-17 *Spanish Composition and Conversation* — Although some grammar review and written work is required, this course aims primarily to develop the ability to engage in Spanish conversation. Prep. 33-16; 4 Class Hrs.; 4 Credit Hrs.

33-18 *Spanish Composition and Conversation* — A continuation of 33-17, with emphasis on free composition, both written and oral. Oral reports serve as bases for class discussions. Prep. 33-17; 4 Class Hrs.; 4 Credit Hrs.

33-19 *Readings from Contemporary Spanish* — In this course selected passages are read from the narrative and dramatic prose of the last fifty years. Among the writers included are Unamuno, "Azorín," Benavente, Ibáñez, Baroja, Valle-Inclán, Ayala, and Ortega y Gasset. Prep. 33-16; 5 Class Hrs.; 2½ Credit Hrs.

33-21 *Spanish Literature of the Golden Age* — This course deals with works of Cervantes, particularly the *Don Quixote* and the *Novelas Ejemplares*. Lectures, collateral reading and reports. Prep. 33-16; 4 Class Hrs.; 4 Credit Hrs.

33-22 *Spanish Literature of the Golden Age* — A continuation of 33-21, with emphasis on the drama of Lope de Vega, Tirso de Molina and Calderón. Lectures, collateral reading and reports. Prep. 33-16; 4 Class Hrs.; 4 Credit Hrs.

33-23 *Spanish Literature of the Nineteenth Century* — A study of the literature of Spain during the first half of the nineteenth century, with emphasis on the Romantic drama and poetry. Lectures, collateral reading and reports. Prep. 33-16; 4 Class Hrs.; 4 Credit Hrs.

33-24 *Spanish Literature of the Nineteenth Century* — A continuation of 33-23, this course is devoted to Spanish literature of the second half of the nineteenth century, particularly to the Realistic novel. Lectures, collateral reading and reports. Prep. 33-16; 4 Class Hrs.; 4 Credit Hrs.

33-25 *Spanish American Literature* — A survey of the general trends of Spanish American literature, with particular attention to the colonial period, the period

of the struggle for independence, and the nineteenth century epic of the Gaucho and the Indian. Lectures, collateral reading and reports. Prep. 33-16; 4 Class Hrs.; 4 Credit Hrs.

33-26 *Spanish American Literature* — A continuation of 33-25, this course deals with the better known Spanish American writers of the Modernistic, Realistic and Contemporary periods, with emphasis on Rubén Darío and Gabriela Mistral. Lectures, collateral reading and reports. Prep. 33-16; 4 Class Hrs.; 4 Credit Hrs.

Russian

34-01 *Elementary Russian* — A beginner's course stressing the essentials of grammar, practice in pronunciation, and progressive acquisition of a basic vocabulary and idiomatic expression. 5 Class Hrs.; 5 Credit Hrs.

34-02 *Elementary Russian* — A continuation of 34-01, with emphasis on the more difficult points of grammar, additional vocabulary, and reading of simple prose. 5 Class Hrs.; 5 Credit Hrs.

34-03 *Intermediate Russian* — Although some grammar review and written work is required, this course aims primarily at developing the ability to read prose of moderate difficulty. 5 Class Hrs.; 5 Credit Hrs.

34-04 *Intermediate Russian* — A continuation of 34-03, with emphasis on the reading of scientific prose. 5 Class Hrs.; 5 Credit Hrs.

Accounting

41-01 *Principles of Accounting* — The purpose of this course is to offer training in the understanding of the principles and practice of elementary accounting. It is designed to serve the needs of those who intend to specialize in accounting as well as those who are studying it as a tool subject. The student is acquainted with the entire cycle of bookkeeping procedure: journalizing, posting, taking a trial balance, preparing working papers and statements, and closing the books, as well as the analysis of transactions. 4 Class Hrs.; 4 Credit Hrs.

41-02 *Principles of Accounting* — This course continues the work in 41-01 with a complete treatment of the analysis of transactions, after which attention is directed to the more formal forms of the recording process. The course takes up the use of special journals and ledgers, controlling accounts, accrued and deferred items, estimating allowances for bad debts and depreciation, and the accounting for negotiable instruments. Prep. 41-01; 4 Class Hrs.; 4 Credit Hrs.

41-03 *Principles of Accounting* — This course continues the work of 41-02 with a discussion of the voucher system and matters related to payrolls. Then follows an introductory treatment of the accounting features peculiar to the individual proprietorship, the partnership and the corporation, with emphasis on the concept of owner equity. Prep. 41-02; 4 Class Hrs.; 4 Credit Hrs.

41-10 *Principles of Accounting* — This course is offered to those students who are entering the College of Business Administration at the sophomore level. The purpose of the course is to present the fundamental principles of accounting theory and practice in sufficient detail and scope to provide adequate foundation for either advanced study in accounting or the accounting phases in the study of industrial relations, management and marketing. 10 Class Hrs.; 10 Credit Hrs.

41-26 *Intermediate Accounting* — This course is a continuation of 41-03 with emphasis shifting from the achievement of technical facility into the analytical, interpretive, and managerial aspects of accounting. Emphasis is placed on the logical development of accounting rules and principles from fundamental accounting theory. The course coverage includes a comprehensive discussion of the theory and the analysis of accounting statements, the analysis of working capital, profit and loss analysis, and miscellaneous ratios. Prep. 41-03; 4 Class Hrs.; 4 Credit Hrs.

41-27 *Accounting Statements* — This course is a survey of the basic accounting statements. The five areas that are covered are as follows: (1) an explanation of the form, content, and general principles governing the construction of financial statements; (2) a study of accounting valuation and income determination problems; (3) an extensive examination of working capital; (4) a detailed coverage of comparative statements including trend percentages and common-size statements; and (5) a complete study of all the standard ratios followed by the methods and techniques of using them in analyzing and interpreting financial and operating data. Prep. 41-03; 4 Class Hrs.; 4 Credit Hrs.

41-28 *Introduction to Cost Accounting* — This course is a survey of the basic cost accounting principles as it applies to non-accounting majors. It is intended to demonstrate the principles, procedures, and management uses of cost accounting. The course will cover the following: manufacturing costs; nature and uses of cost accounting; outline of the job cost plan; managerial control of material, labor, and overhead; departmental burden rates; and financial statements. Cost control through cost reports and an analysis and control of distribution costs will be studied. 4 Class Hrs.; 4 Credit Hrs.

41-31 *Cost Accounting* — Discussion of basic cost accounting terminology is followed by the job-order cost accounting cycle which shows the flow of costs through the general ledger and their presentation on financial statements. The following topics are then covered: the voucher system, special ledgers, materials inventory control, accounting for labor, and manufacturing expenses — actual and applied. The departmentalization of the factory is studied. Prep. 41-28; 2 Class Hrs.; 2 Lab. Hrs.; 3 Credit Hrs.

41-32 *Cost Accounting* — This course begins with a review of the area of job-order cost accounting. Considerable time is devoted to the area of process cost accounting and the costing of by-products and joint products. Emphasis is placed on the averaging method and first-in, first-out method of costing. These are the two methods of costing used in process cost accounting. The last part of the course introduces standard cost accounting accompanied by budgetary control. Prep. 41-31; 2 Class Hrs.; 2 Lab. Hrs.; 3 Credit Hrs.

41-33 *Cost Accounting for Management* — Standard cost accounting combined with budgetary control is today gaining widespread importance with management. Business seeks control of many of its activities through the establishment of standards and budgets. Since both have managerial control as its objective the two areas are interdependent and cannot function separately. The first portion of the course will deal with basic budgetary procedure with emphasis on the flexible or variable budget. This will be followed by a survey of standard cost accounting accompanied by budgetary control. Cost control techniques and procedures such as gross profit analysis, break-even analysis, and profit-volume relationship will also be discussed. Prep. 41-28; 10 Class Hrs.; 5 Credit Hrs.

41-34 *Industrial Accounting* — This course provides a foundation in basic principles and procedures. Emphasis is placed on the recording of the ordinary transactions of a trading business, the preparation of financial statements, and the handling of controlling accounts and subsidiary ledgers. The purely clerical work incidental to the study of basic accounting is minimized and stress is laid on the ways in which accounting serves management in administering a business successfully. 3 Class Hrs.; 3 Credit Hrs.

41-35 *Industrial Accounting* — The purpose of this course is to provide engineering students with a foundation in cost accounting theory and practice. The student is made conversant with the field and purposes of cost accounting, the procedures in accounting for material, labor, and manufacturing expenses in a job order cost system, process cost accounting, cost accounting with the use of standards, cost accounting for by-products and joint products, and budgetary practices and procedures.

Emphasis throughout the course is on the use of cost accounting data as a tool of management in the control and possible reduction of costs and as a guide to management in shaping future policies and operations. Prep. 41-34; 5 Class Hrs.; 5 Credit Hrs.

41-37 *Intermediate Accounting* — This course in Intermediate Accounting is designed to serve as a foundation for advanced accounting work. This calls for a broad and thorough understanding of basic accounting theory and its general application to business. The course begins with a series of studies describing in detail the accounting problems relating to valuation and presentation of corporate property, liability and equity items, as well as the related problems of measurement of cost and revenue. Prep. 41-26; 2 Class Hrs.; 2 Lab. Hrs.; 3 Credit Hrs.

41-38 *Intermediate Accounting* — This course is a continuation of 41-37. Here fundamental theory receives extended application. The purpose of this course is to broaden the base of the student's knowledge of subjects which are in a transitional and controversial stage. Both sides of controversial subjects are presented and frequent reference is made to the expressed opinions of the American Institute of Accountants, the American Accounting Association, and the Securities and Exchange Commission. Prep. 41-37; 2 Class Hrs.; 2 Lab. Hrs.; 3 Credit Hrs.

41-42 Budget Procedure — The purpose of this course is to give consideration to the basic principles and procedures to be applied in the preparation of a comprehensive budget program. The principal techniques of budget construction that have general application to most business concerns are covered. Emphasis is placed upon the practical study of these techniques including such areas as: sales, production, purchases, labor, cost control, budget variations and reports. Prep. 41-33; 5 Class Hrs.; 2½ Credit Hrs.

41-43 Auditing — This is a course in auditing principles and procedures designed to acquaint the student with the most current auditing concepts. Emphasis is placed on auditing objectives, the coordination of the examination of accounts, and their effect upon the balance sheet and income statements. Practical problems developed out of public accounting practice C.P.A. examination questions are used. Prep. 41-38; 3 Class Hrs.; 3 Credit Hrs.

41-44 Auditing — This course continues the work started in 41-43. The publications of the American Institute of Certified Public Accountants are used extensively as part of the text materials. Audit programs are studied and formulated by the student. In addition the pronouncements and opinions of The Institute of Internal Auditors, the American Accounting Association, and The Securities and Exchange Commission are studied and used whenever applicable. Prep. 41-43; 3 Class Hrs.; 3 Credit Hrs.

41-45 Advanced Accounting I — This is a continuation of 41-38. Course coverage includes formation, operation, dissolution upon ownership changes, and liquidation of partnerships and joint ventures. The second part of the course emphasizes special sales procedures, viz., installment sales, consignments, and home office and branch relationships. Prep. 41-38; 3 Class Hrs.; 3 Credit Hrs.

41-47 Consolidated Statements — Among many business enterprises there exists a parent-and-subsidary relationship. In our complex business society this trend towards combination and control continues. It becomes necessary periodically to combine corresponding items of the parent and its subsidiary or subsidiaries so that the end result presents a financial picture as though they were a single economic unit. This course is concerned with a detailed study of the accounting and economic problems involved in the preparation of these consolidated statements. Prep. 41-45; 3 Class Hrs.; 3 Credit Hrs.

41-48 Cost Accounting — Standard cost accounting and budgetary control are continued in this course. The interdependence of budgeting and standard cost accounting is stressed. Problems using standard costs with flexible budgets are illustrated. Cost accounting as a "tool of management" is studied. Topics included are cost control through cost reports, analysis and control of distribution costs, gross profit analysis, break-even analysis, profit-volume relationship, and differential cost analysis. Prep. 41-32; 3 Class Hrs.; 3 Credit Hrs.

41-55 Advanced Accounting II — This course is in three parts: (1) accounting for fiduciaries, (2) actuarial science and (3) accounting for governmental units. Content of the first part includes statement of affairs, receiverships, statement of realization and liquidation, estates, and trusts; the second part includes a discus-

sion of compound interest amounts, and present values; the last part of the course consists of a brief survey of the accounting for municipalities and institutions. Prep. 41-45; 3 Class Hrs.; 3 Credit Hrs.

41-60 *Accounting Seminar I* — The attempt is made in this course and in 41-61 to study the historical progress of accounting, to relate accounting to the other disciplines — economics, law, statistics, and to study the development and present position of the basic concepts, conventions, and principles which underlie accounting. The student selects an approved topic dealing with a specific aspect of accounting theory or procedure and develops a detailed outline for a paper to be presented in 14-61. The major portion of the time is spent in discussion of general concepts based on extensive readings in the ever-growing body of accounting literature. 3 Class Hrs.; 3 Credit Hrs.

41-61 *Accounting Seminar II* — This course is devoted primarily to the discussion and presentation of research papers. This will provide the opportunity for the free expression of views particularly in areas of controversy. The students are encouraged to take positions, to express their views, and to bring out areas of agreement and disagreement. 2 Class Hrs.; 2 Credit Hrs.

Industrial Relations

42-10 *Personnel* — The purpose of this course is to survey the personnel function as an element of management. This course deals with the humanistic side of personnel relations as opposed to the technical aspects. Emphasis is placed on the development of a sound philosophy of employer-employee relations. 3 Class Hrs.; 3 Credit Hrs.

42-44 *Wage Administration* — This course includes both practical and theoretical issues of wages and income; the economic and social function of wages, wage theories, wage practices of industrial management, collective bargaining of wage adjustments, fringe issues, legislative supplements, income security, and national wage policy. Prep. 20-26; 3 Class Hrs.; 3 Credit Hrs.

42-52 *Motion and Time Study* — This course is designed for students in Business Administration to show the proper use of work simplification and time study. The student is instructed in the use of process analysis, operation analysis, man-machine analysis, and micromotion analysis. This is accomplished through lectures, discussions and actual laboratory projects.

Time study is discussed and the student is instructed in the correct use of it and how this tool can be used as an aid to management. Prep. 45-54, 45-22; 2 Class Hrs.; 2 Lab. Hrs.; 3 Credit Hrs.

42-61 *Seminar in Collective Bargaining* — The meetings will be devoted to discussion of cases or reports on problems actually faced by industrial relations

departments dealing with employees through collective bargaining. Broad issues of management authority, governmental regulation of labor-management relations, grievance procedures and arbitration will be analyzed. Research into more specific issues will be undertaken by students. Prep. 20-26; 4 Class Hrs.; 4 Credit Hrs.

Marketing and Advertising

43-21 *Principles of Marketing* — The principles and trends governing the marketing and distribution of merchandise are introduced in this course together with detailed consideration of the place of marketing in our modern economic order, the basic structure of markets, commodities, middlemen, and the field of retailing. 3 Class Hrs.; 3 Credit Hrs.

43-22 *Principles of Advertising* — The economic background of advertising and its development are presented together with a study of the methods followed in advertising agencies and departments to plan and prepare advertisements and advertising campaigns. 3 Class Hrs.; 3 Credit Hrs.

43-30 *Salesmanship* — The objective of this course is twofold: (1) To provide the student who is interested in a career in marketing and advertising, but not necessarily in personal selling, with a working and essential knowledge of sales functions and procedures and the role of the salesman in modern marketing process; (2) for those students interested in entering the field of personal selling as a career, a greater knowledge of modern selling techniques, including a thorough appreciation and understanding of the relation that exists between personal selling and the many marketing aids and techniques contained in a fully developed sales program. Prep. 43-21, 43-22; 3 Class Hrs.; 3 Credit Hrs.

43-31 *Copywriting* — Facility in dealing with effective advertising copy, whether from the point of view of creating it, selling it, or appraising it, is the aim of this course. Consideration is given to the relation of copy and headline to layout, the preparation of headlines and slogans and the principles of copy construction. Emphasis is placed upon analysis and preparation of the many types of copy required for different purposes and different kinds of advertising media. Prep. 43-21, 43-22; 3 Class Hrs.; 3 Credit Hrs.

43-32 *Sales Management* — Training in the analysis of problems that arise in sales and marketing programs and in the exercise of personal judgment is emphasized through the use of actual case material. A wide variety of case studies, developed in cooperation with business executives by the Division of Business Case Development, present current problems in adding or eliminating product lines; product design, trademark, guaranty and packaging problems; policies in selection of distribution channels; pricing, resale price maintenance, discounts; and sales planning. 3 Class Hrs.; 3 Credit Hrs.

43-33 *Sales Management* — On an advanced level, cases designed for the advanced student encourage the analysis and evaluation in this second term of the course of problems in sales organization and control, sales methods and campaigns, and the control of sales operations. Fully as much as the course content, the case or discussion method used in these two courses serves as a useful

bridge between preceding survey courses and the work required in the more advanced problem and seminar courses. 3 Class Hrs.; 3 Credit Hrs.

43-40 *Advertising Production* — Familiarity with mechanical problems and processes in advertising, including some knowledge of production techniques in television and radio, is the objective of this basic course. Major attention is given to printed advertising — publication, letters, folders, booklets. Elements of the course are: Visualizing the advertising idea; preparing the layout, including lettering and rough sketching; selecting the illustration; the use of color; photo-engraving and other illustrative processes; selection of type; determination of space requirements; printing and paper; and the working out of individual advertising projects. Prep. 43-22; 4 Class Hrs.; 3 Credit Hrs.

43-43 *Marketing Research* — The scope and uses of market research and analysis, together with their basis in scientific method, are considered at some length to reveal specific practical applications of this modern marketing tool to business needs. Quantitative and qualitative sales analysis, market trends, advertising research, product analysis, territory and sales quota determination are considered fully and related to basic methods of measuring the effectiveness of the marketing-advertising operation. Prep. 43-32; 4 Class Hrs.; 4 Credit Hrs.

43-44 *Foreign Marketing* — The purpose of this course is to give the student of marketing a knowledge of the problems, policies, and techniques essential to effective sales in foreign markets. Throughout the course emphasis is placed upon the differences in the nature of the problems encountered and the practices followed in this highly specialized field. Prep. 43-32; 2 Class Hrs.; 2 Credit Hrs.

43-46 *Credits and Collections* — This course is designed to acquaint the student with modern methods of credit investigation, determination, and collections. Consideration will be given to credit instruments, mercantile credit practices and policies, mercantile and special agencies, problems and policies in retail credit, and legal right in collecting. Prep. 43-22; 3 Class Hrs.; 3 Credit Hrs.

43-50 *Industrial Marketing* — This senior course is designed to give those students who elect it a knowledge and understanding of a significant and specialized area of marketing. In the class meetings, selected topics covering a variety of phases of Industrial Marketing, and individual research upon these, are the basis for discussion. 4 Class Hrs.; 4 Credit Hrs.

43-52 *Retail Merchandising* — The purpose of this course is to study the principles of successful retailing and to acquaint the student with the more modern methods of operating a retail organization. The course opens with a review and a more detailed discussion of markups, markdowns, and markons. Consideration is then given to the operating statement as it applies to the retailer, the buying function, pricing of merchandise and the development of price lines, the control of inventory, stock turnover, the selection and management of retail sales personnel, and budgeting. Throughout the course merchandise planning is discussed and illustrated. Prep. 43-33 or 45-52; 4 Class Hrs.; 4 Credit Hrs.

43-53 *Problems in Advertising* — Using case studies drawn up by the Division of Business Case Development, this course comprehends a wide variety of basic promotional problems in representative industries and firms. Careful at-

tention is given to analysis and solution of divergent problems involving the effective use of advertising in relation to the marketing strategy as a whole. The cases illustrate significant differences in buying habits and motives and afford opportunity to appraise a broad range of advertising and sales promotion programs precisely as they were evolved. Prep. 43-22, 43-32; 3 Class Hrs.; 3 Credit Hrs.

43-54 *Problems in Advertising* — Concluding the case work carried on in 43-53, this course seeks to develop a thorough understanding of the administrative aspects of advertising from both the advertiser's and the advertising agent's point of view and at the same time to develop a deeper comprehension of the economic effects of advertising and sales promotion. Using materials designed for advanced students, it intensifies previous study with particular respect to media selection, and control and measurement of advertising effort. Latest methods of sales promotion are demonstrated in class. Taking a broad view on the basis of individual cases it also analyzes the influences of advertising and allied promotions upon our economy. Prep. 43-53; 4 Class Hrs.; 4 Credit Hrs.

43-61 *Seminar in Marketing and Advertising* — This seminar course, taken in the senior year, is designed to give students majoring in the field an opportunity to pursue further those specific aspects of marketing or advertising which are of particular interest to the student and in which he feels the need for additional information and training. Individual research and reports are the basis of the seminar meetings. 3 Class Hrs.; 3 Credit Hrs.

Finance and Insurance

44-13 *Construction Finance* — The financial problems confronting the setting up of engineering and construction organizations and the methods of providing funds to carry on projects constitute the subject matter to be studied. This will include a consideration of the various forms of business organization from the legal as well as the operational point of view. The uses of capital stock, mortgage bonds, land trust certificates, purchase money mortgages, together with the importance of appraisals in the financing of public projects, projects of private enterprise, public utilities, and expansion of these services are studied. The problems of providing working capital and the use of bank credit are also considered. 2 Class Hrs.; 2 Credit Hrs.

44-20 *Introduction to Finance* — An introductory survey designed to acquaint the student with the role of finance in the economic world. The survey includes capital formation and uses, financial institutions and their functions, descriptive analysis of banks, investment companies, insurance companies and brokerage houses, farm credit organizations, and consumer credit agencies. 3 Class Hrs.; 3 Credit Hrs.

44-22 *Principles of Insurance* — The purpose of the course is to provide a comprehensive knowledge of insurance principles and coverage such as will provide a broad foundation for the student who plans to enter the business of insurance or enable the man or woman in business to plan a satisfactory program for personal needs or business responsibilities. Content: the basic principles of

insurance, solving the economic problems of risk, types of insurance contracts, legal interpretation of the insurance contract, types of insurance, co-operative organizations in the field of insurance. 3 Class Hrs.; 3 Credit Hrs.

44-31 *Business Finance* — The fundamental principles of finance are approached from the point of view of the business man. Methods of organizing and financing new and old business ventures are integrated with present-day practice. Merits of partnerships and corporations from the standpoint of liability, risk and taxes are considered. Consideration is given to the various factors that influence capital structure and the services of the investment banker; the Securities Exchange Act and Blue Sky Laws; the liabilities and privileges of stockholders and directors. Prep. 44-20; 4 Class Hrs.; 4 Credit Hrs.

44-32 *Business Finance* — This course covers the financial aspects of sales, prices and markets; methods of raising short-term working capital and problems involved in keeping it revolving. The proper administration of income to meet the objectives of the company, and the part played by depreciation surplus and dividend policy are considered. Methods of evaluation as applied to various types of business from the standpoint of the buyer and seller. The course also includes principles to be applied in consolidating or merging companies or recapitalizing problems dealing with receivership and bankruptcy. Prep. 44-31; 4 Class Hrs.; 4 Credit Hrs.

44-33 *Life Insurance* — A study of life insurance and its place in planning an estate. A detailed study of policy provisions; how rates are made; measuring the net cost of insurance; present-day reserve systems; how dividends are calculated; group and accident policies; investments of life insurance companies; and legal aspects of life insurance. Prep. 44-22; 3 Class Hrs.; 3 Credit Hrs.

44-34 *Property Insurance* — A detailed study of the fire insurance contract with special reference to restricting clauses; warranties, waiver and added forms and clauses; rate structure; underwriting problems; consequential losses and claim settlement; insurance of goods in transit; kinds of policies; coverage and rate making. Prep. 44-33; 3 Class Hrs.; 3 Credit Hrs.

44-35 *Estate Planning and Taxation* — The property estate is considered in respect to its distribution for the purpose of satisfying particular needs. Trust administration, wills, etc. are considered from the viewpoint of the estate planner. Prep. 44-22; 3 Class Hrs.; 3 Credit Hrs.

44-36 *Estate Planning and Taxation* — A continuation of 44-35. Income, gift, and estate taxes are considered both in their bearing on financial decisions in business and in their relation to life insurance and estate planning. Prep. 44-35; 3 Class Hrs.; 3 Credit Hrs.

44-41 *Investments* — This course is concerned with investment analysis. It covers methods of analyzing the industry, the particular company in the industry, and the specific securities of the company. Factors that enter into the rating of stocks and bonds, such as number of times interest earned, capital structure and asset value are taken up in order. Also included is a study of protective covenants and remedies of junior and senior security holders. Prep. 44-32; 3 Class Hrs.; 3 Credit Hrs.

44-42 Investments — This course is concerned with the problems of managing investment funds. Through the study of case material and readings, principles are developed for analyzing the particular investment needs of an individual or institution. Then comes the selection of securities to fit the need. The advantage and disadvantage of stocks and bonds and all types of investments are related to fluctuations in the business cycle and money market conditions. Prep. 44-41; 3 Class Hrs.; 3 Credit Hrs.

44-51 Trust Management — This course deals with the creation of personal and corporate trusts, functions of the trust officer, legal rights and duties of the parties, problems of lifeman and remainderman, government supervision, and investment problems. Prep. 44-42; 3 Class Hrs.; 3 Credit Hrs.

44-52 Security Markets — This is a study of our security markets, how securities are bought and sold, the future market, the brokerage house, government regulation, and the problems of pricing. Prep. 44-42; 3 Class Hrs.; 3 Credit Hrs.

44-61 Seminar in Finance and Insurance — This senior course is intended to give students majoring in the field of finance and insurance an opportunity to pursue research work in the specific aspects of this field. Each student selects a topic in which he has a particular interest and where he feels the need of additional information. Oral reports, group discussion. Prep. 44-42; 4 Class Hrs.; 4 Credit Hrs.

44-62 Seminar in Finance and Insurance — This course gives the student the opportunity to continue the individual research and group discussions which began in 44-61. Prep. 44-61; 4 Class Hrs.; 4 Credit Hrs.

Business Management

45-21 Principles of Business Management — This course is intended to present the basic principles which are involved in the several areas of management activity. It is designed as a first approach for students into the policies and problems encountered in business. The study revolves about the initiation and operation of business from the viewpoint of financing the organization of personnel, the use of physical facilities and the operating features of a going concern as they pertain to the use of men, machines, and money. 3 Class Hrs.; 3 Credit Hrs.

45-22 Principles of Business Management — A continuation of 45-21 in which emphasis is placed upon personnel evaluation, rating, and methods of payment, the control of production and the relation of costing and sales procedures to the efficiency and management of the enterprise. Prep. 45-21; 3 Class Hrs.; 3 Credit Hrs.

45-35 Production Management — This course will analyze management problems in the area of production. Case studies are used as a basis for discussing

problems of plant and equipment, materials and purchasing, control of production and cost control. Prep. 45-21, 45-22; 3 Class Hrs.; 3 Credit Hrs.

45-36 *Personnel* — This course will analyze the development of personnel policy and personnel administration as a tool of management. Timely, significant manpower problems in industry and case studies are used to develop subject matter in this field. Topics covered include the nature and scope of personnel administration, analyzing personnel problems, wages and work assignments. Prep. 45-21, 45-22; 3 Class Hrs.; 3 Credit Hrs.

45-37 *Personnel Administration* — Continued development and discussion of topics listed in 45-36. Prep. 45-21, 45-22; 3 Class Hrs.; 3 Credit Hrs.

45-52 *Management of Sales* — This seminar course, taken in the first term of the Senior year, is intended to give students majoring in Business Management an opportunity to examine the organization and the operation of the firm's sales department. Emphasis is placed upon management's interest in effective marketing and the co-ordination of sales with other operations and departments of the firm. Prep. 45-34; 2 Class Hrs.; 2 Credit Hrs.

45-61 *Seminar in Policy and Organization* — In this course senior students will analyze and appraise a variety of simulated business problems. The purpose of this course is to develop a way of thinking logically and meaningfully in a given business situation. Students are required to broaden their understanding of business principles through readings in a variety of areas. 3 Class Hrs. 3 Credit Hrs.

45-62 *Seminar in Management* — The purpose of this course is to present to the senior student of Business Management an opportunity to investigate, analyze and report on various types of problems which confront contemporary management. The student is given the opportunity to demonstrate his capacity to apply basic principles of management in a wide variety of business situations. Course is limited to Business Management seniors. 4 Class Hrs.; 4 Credit Hrs.

Business Law

46-03 *Contracts and Agency* — This course is designed to give a fundamental knowledge of basic legal principles to the engineering student through the study of the origin and development of law; the elements of contract, the agency relationship and its operation; the law of workmen's liens and the origin and expansion of the law in workmen's compensation. 6 Class Hrs.; 3 Credit Hrs.

46-41 *Legal Aspects of Business I* — Through the use of text and case materials, the basic business law principles involved in contracts, sales, credit instruments and creditors' rights are examined. 4 Class Hrs.; 4 Credit Hrs.

46-42 *Legal Aspects of Business II* — This course is a continuation of the above, and it concerns itself with a study of the legal aspects of the various forms of business organization, including agency, partnership, and corporation, through which contracts are made. 4 Class Hrs., 4 Credit Hrs.

46-53 *Basic Federal Taxes* — A comprehensive study of the latest Internal Revenue Code and Treasury Regulations including the preparation of returns for individuals. Problems and cases are discussed involving taxable income — inclusions and exclusions, capital gains and losses, dividends, and expense deductions. 2 Class Hrs.; 2 Lab. Hrs.; 3 Credit Hrs.

46-54 *Basic Federal Taxes* — This course is a continuation of 46-53. The sections of the Code pertaining to partnerships, corporations, and fiduciaries are taken up including the preparation and filing of returns. Research problems are assigned to the students in order to acquaint them with the working tools of tax practice — the complete Federal Tax Library. Problems in policy planning for tax economies are presented. 2 Class Hrs.; 2 Lab. Hrs.; 3 Credit Hrs.

46-55 *Labor Law* — This course studies the historical development of legal principles as applied to labor relations by the courts since 1800. Labor decisions under the Sherman Act are discussed as well as the modifications set forth by 20th century labor legislation. Prep. 20-26; 3 Class Hrs.; 3 Credit Hrs.

46-56 *Law of Merchandising* — A study of the legal problems which arise in connection with the marketing of merchandise including legal problems involved in advertising, price-fixing, anti-trust laws, and unfair sales. Prep. 46-42; 4 Class Hrs.; 4 Credit Hrs.

46-57 *Law of Corporate Finance and Insurance* — This course includes a study of the legal responsibilities of public accountants for audit certificates, legal incidents in corporate finance, including federal and state regulation of securities, and current problems, principles, and concepts of insurance law. Prep. 46-42; 4 Class Hrs.; 4 Credit Hrs.

Secretarial Studies

47-01 *Typing I* — This course provides basic training in typewriting with emphasis on a complete mastery of the keyboard and the development of speed and accuracy. 3 Class Hrs.; 5 Lab. Hrs.; 3 Credit Hrs.

47-02 *Typing II* — This course continues the work begun in 47-01 with a reconstruction of basic skills and further development of speed and accuracy. Instruction is given in centering, tabulation, and business letters. 3 Class Hrs.; 5 Lab. Hrs.; 3 Credit Hrs.

47-03 *Typing III* — Advanced problems in planning and arranging letters, reports, and tabulations are worked out. Attention is given to the preparation of these and other college papers. 3 Class Hrs.; 5 Lab. Hrs.; 3 Credit Hrs.

47-04 *Typing IV* — The student's goal in this course is the attainment of a high degree of proficiency to enable him to enter office employment as a competent typist. The emphasis is on office standards of speed, accuracy, and arrangement. 3 Class Hrs.; 5 Lab. Hrs.; 1½ Credit Hrs.

47-09 *Typing* — This is an intensive course in beginning typing for students who cannot take the 47-11 and 47-12 sequence. The principal aim is to give the student a foundation of correct typing techniques sufficient for personal use. 3 Class Hrs.; 6 Lab. Hrs.; 3 Credit Hrs.

47-11 *Typing A* — This course provides a thorough foundation in typewriting. Emphasis is placed on a mastery of the keyboard and the development of speed and accuracy. Instruction is given in horizontal and vertical centering and in simple letter forms. 4 Class Hrs.; 6 Lab. Hrs.; 4 Credit Hrs.

47-12 *Typing B* — This course continues the work in 47-11 with a reconstruction of basic skills and further development of speed and accuracy. Instruction is given in the typing of business letters, tabulations, and rough drafts. The typing of manuscripts such as term reports and theses is an important part of the course. Prep. 47-11; 4 Class Hrs.; 6 Lab. Hrs.; 4 Credit Hrs.

47-13 *Briefhand I* — The aim of this course is mastery of the principles of Briefhand — a rapid notetaking system using the longhand alphabet. 4 Class Hrs.; 4 Credit Hrs.

47-14 *Briefhand II* — The theory of Briefhand is reviewed in this course. Emphasis is on the building of speed in notetaking. Prep. 47-13; 4 Class Hrs. 4 Credit Hrs.

47-17, 47-18 *Secretarial Procedures* — The best current procedures and practices in secretarial work are studied so students may be prepared for employment in various businesses. 3 Class Hrs.; 3 Credit Hrs.

47-21 *Transcription I* — Development of shorthand speed is continued in this course until the student acquires a speed sufficient for ordinary office dictation. Transcription training is introduced with emphasis on the mailability of transcribed letters. Prep. 8 credits in typing and 8 credits in shorthand; 4 Class Hrs.; 4 Credit Hrs.

47-22 *Transcription II* — The transcription training begun in 47-21 is continued in this course with emphasis on the improvement of shorthand, typing, and English skills. The objective of the course is a marketable skill enabling the student to compete for stenographic employment. Prep. 47-21; 4 Class Hrs.; 4 Credit Hrs.

Co-ordination

50-01 *Professional Development* — A course designed to orient the student's thinking along individual professional development lines, and to familiarize him with an intelligent technique of job getting.

The professional development portion includes several lectures by professional engineers to the combined senior class covering the Activities of ECPD and EJC, Engineering Licensure, the U. S. Patent System, and Ethics in Engineering Practice. At the class sessions the professional department chairmen discuss with their own senior students the various aspects of professionalism.

Concurrently, the technique of job getting is discussed. This includes a survey of the occupational field, a market survey of opportunities, and a study of accepted techniques for obtaining the desired position. 3 Class Hrs.; 1 Credit Hr.

50-10 Placement Techniques — An over-all discussion of job-getting techniques covering in order such items as a survey of the occupational field wherein the students' training can be profitably applied, a market survey of opportunities, a study of the accepted techniques related to job-getting efforts, such as qualification records, prospect files, letter writing, interviews, etc., planning and executing the job-getting campaign. 2 Class Hrs.; 1 Credit Hr.

Military Science and Tactics

61-01 Military Science I — An introductory course in military fundamentals and objectives required of all persons entering military service, including organization of the Army and ROTC leadership, care of the uniform and rifle, military courtesy, discipline, and drill. 1 Class Hr.; 2 Lab. Hrs.; 1 Credit Hr.

61-02 Military Science I — A Research of American Military History, outlining important steps in the formation of the modern Army, relationship with other governmental agencies and the exercise of command responsibilities by prominent military leaders. 3 Class Hrs.; 1 Credit Hr.

61-03 Military Science I — Students are trained in care, functioning and use of individual arms (weapons), to include marksmanship training and firing on the indoor rifle range. 1 Class Hr.; 2 Lab. Hrs.; 1 Credit Hr.

61-10 Military Science II — Provides special drill and leadership techniques instruction for potential non-commissioned officers within the Cadet Brigade. 1 Class Hr.; 2 Lab. Hrs.; 1 Credit Hr.

61-11 Military Science II — Students are assigned to noncommissioned officer positions within the Cadet Brigade and receive training in small unit leadership and command in preparation for the advanced course. Also includes training with crew served weapons, their operation and tactical employment. 1 Class Hr.; 3 Lab. Hrs.; 1 Credit Hr.

61-12 Military Science II — A study of basic Military tactics and elementary communication techniques. Also includes the principles of map and aerial photograph interpretation. 3 Class Hrs.; 1 Lab. Hr.; 1 Credit Hr.

61-20 Military Science II — Advanced course ROTC orientation emphasizing the principles, techniques and characteristics of leadership. Moral and ethical standards expected of officers of the Armed Forces are developed as are the principles of military courtesy and discipline, and customs of the service. 2 Class Hrs.; 0 Credit Hrs.

61-21 Military Science III — The new cadet officers are segregated into a special battalion and begin an intensive, personalized, "officer candidate" type of instruction under specially selected Army officers and noncommissioned and cadet officers from the senior class. They occupy successively all positions in the battalion learning by actual performance under close observation the principles of leadership and command. Also familiarizes the student with principles

of military teaching to include practice teaching, and provides orientation on communications problems in the Infantry Division. 3 Class Hrs.; 2 Lab. Hrs.; 3 Credit Hrs.

61-22 *Military Science III* — Orients the student in the principles of telephony and familiarizes him with the problems encountered in the handling of messages. 4 Class Hrs.; 3 Credit Hrs.

61-30 *Military Science III* — Familiarizes the students with Signal Orders, the written directives of the commander for administration and co-ordination of communications. 2 Class Hrs.; 0 Credit Hrs.

61-31 *Military Science III* — Cadet officers are assigned to junior command positions and continue with their closely supervised, personalized, "officer candidate" type training. Training becomes more personalized, laggards and leaders are separated and handled differently. Special attention is given to individual voice development in speech and command. Principles of command psychology are explained and developed and errors are analyzed. Duties and requirements for final year in Cadet Brigade are taught. Also includes an examination of the principles of radio and introduction to Military Intelligence, including gathering, evaluation, and use. 3 Class Hrs.; 2 Lab. Hrs.; 3 Credit Hrs.

61-32 *Military Science IV* — Familiarizes student with army radio systems and with the communications requirements of higher headquarters. Also includes résumé of army photographic activities. 4 Class Hrs.; 3 Credit Hrs.

61-40 *Military Science IV* — Familiarizes student with principles of military law and the operations of military courts. 3 Class Hrs.; 0 Credit Hrs.

61-41 *Military Science IV* — In the senior year, cadets are promoted to positions of high leadership in the Corps of Cadets. They command the brigades, battle groups, companies and platoons, or serve as staff officers, in cadet grades from First Lieutenant to Brigadier General. They are responsible, under supervision of Army officers and noncommissioned officers, for complete training and operation of the Cadet Brigade. They put into practice the leadership and command techniques they have learned in earlier years and gain experience, which qualifies them for commissions in the United States Army. Also includes study of military administration, Army staff procedures and the Army logistics system. 2 Lab. Hrs.; 3 Credit Hrs.

61-42 *Military Science IV* — Familiarizes student with Army telephone carrier systems and includes orientation in customs of the service. 4 Class Hrs.; 3 Credit Hrs.

61-60 *Military Science III* — Advanced course ROTC orientation emphasizing the principles, techniques and characteristics of leadership. Moral and ethical standards expected of officers of the Armed Forces are developed as are the principles of military courtesy and discipline, and customs of the service. 2 Class Hrs.; 0 Credit Hrs.

61-61 *Military Science III* — The new cadet officers are segregated into a special battalion and begin an intensive, personalized "officer candidate" type of instruction under specially selected Army officers and noncommissioned and cadet officers from the senior class. They occupy successively all positions in the battle group learning by actual performance under close observation the principles of leadership and command. Familiarizes student with principles of military teaching to include practice teaching by students. Also includes a study of field fortifications. 3 Class Hrs.; 2 Lab. Hrs.; 3 Credit Hrs.

61-62 *Military Science III* — Familiarizes student with mine warfare, fixed and floating bridges, and engineer transportation services. 4 Class Hrs.; 3 Credit Hrs.

61-70 *Military Science III* — Gives student a theoretical knowledge of military explosives. 2 Class Hrs.; 0 Credit Hrs.

61-71 *Military Science III* — Cadet officers are assigned to junior command positions and continue with their closely supervised, personalized, "officer candidate" type training. Training becomes more personalized, laggards and leaders are separated and handled differently. Special attention is given to individual voice development in speech and command. Principles of command psychology are explained and developed, and errors are analyzed. Duties and requirements for final year in Cadet Brigade are taught. Also includes a study of construction materials and computations and maintenance of engineer equipment. 3 Class Hrs.; 2 Lab. Hrs.; 3 Credit Hrs.

61-72 *Military Science IV* — A study of military roads and airfields to include specifications and design criteria. Also includes an analysis of the army logistics system and familiarization with military administration. 4 Class Hrs.; 3 Credit Hrs.

61-80 *Military Science IV* — Gives student a working knowledge of the staff procedure of an engineer battalion. 3 Class Hrs.; 0 Credit Hrs.

61-81 *Military Science IV* — In the senior year, cadets are promoted to positions of high leadership in the Corps of Cadets. They command the brigades, battle groups, companies and platoons, or serve as staff officers in cadet grades from First Lieutenant to Brigadier General. They are responsible, under supervision of Army officers and noncommissioned officers, for complete training and operation of the Cadet Brigade. They put into practice the leadership and command techniques they have learned in earlier years and gain experience which qualifies them for commissions in the United States Army. Also includes an examination of the engineer program for wartime buildings and utilities and a study of military law. 3 Class Hrs.; 2 Lab. Hrs.; 3 Credit Hrs.

61-82 *Military Science IV* — Gives student a working knowledge of the operations performed by an engineer battalion. Also includes orientation on military courtesy and customs of the service. 4 Class Hrs.; 3 Credit Hrs.

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NORTHEASTERN UNIVERSITY



1960-1961 University College Bulletin

Boston 15,
Massachusetts



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University College

360 HUNTINGTON AVENUE
BOSTON 15, MASSACHUSETTS

ALBERT E. EVERETT, DEAN

July 1, 1960

Dear Friends:

May I express my sincere greetings as Dean of University College to you who are contemplating further study to prepare yourselves for opportunities which can be yours. The years ahead hold unlimited promise for those who are prepared to accept the challenge. The ever-increasing complexity of our business and industrial structure, however, will demand more of each of us. The choice is yours - whether you will be a part of the main stream or will drift into a stagnant backwater.

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Albert E. Everett
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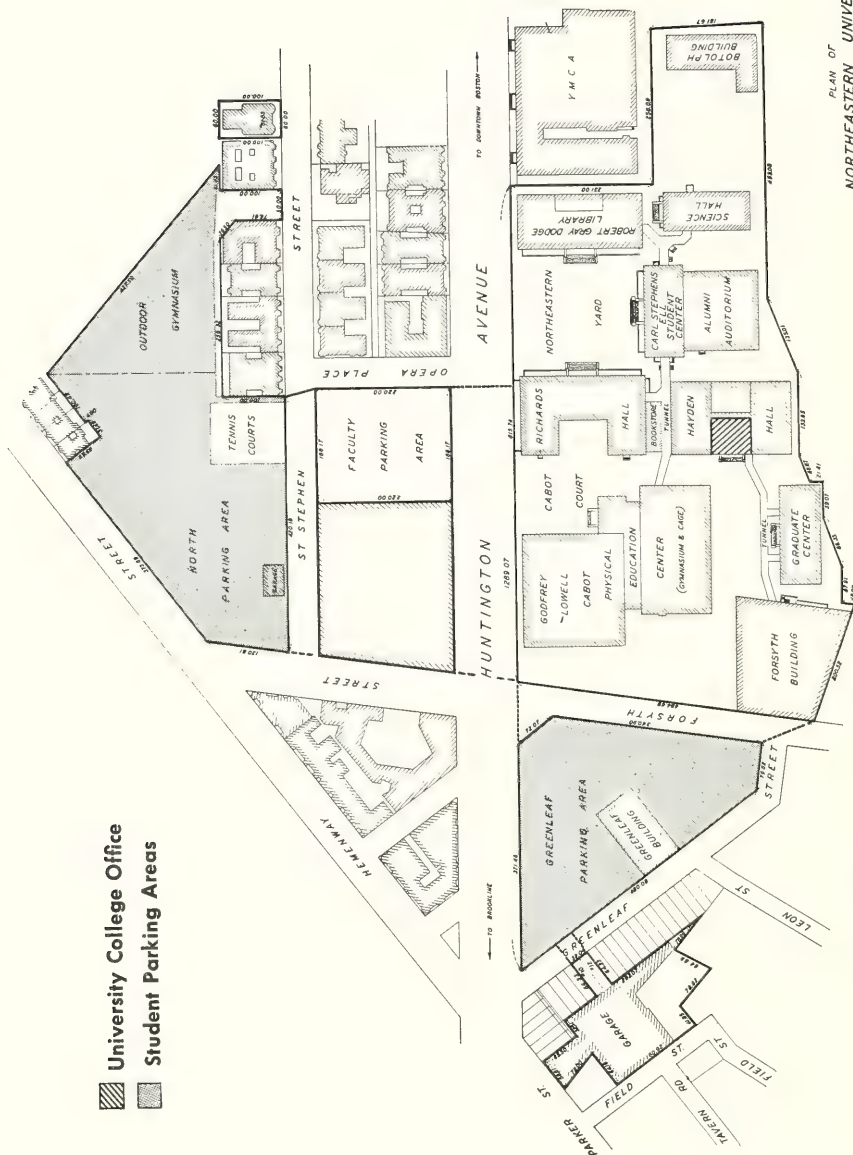
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August 22, 1960 — June 24, 1961

Monday — Friday 8:45 A.M.—8:30 P.M.

Saturdays 8:45 A.M.—12:00 NOON

The office is closed on all legal holidays.

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Prospective students, or those desiring advice or guidance regarding any part of the college work or curricula, are encouraged to arrange for personal interviews with the Dean or other officers of instruction. Career planning through competent guidance provides an understanding of professional requirements and develops that definiteness of purpose so vital to success.

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Calendar

1960

Summer session classes begin	May	31
Commencement	June	19
Legal Holiday — No class sessions	July	4
Summer session classes end	September	1
Fall semester classes begin	September	26
Legal Holiday — No class sessions	October	12
Week for first term tests	October	24-29
Legal Holiday — No class sessions	November	11
Legal Holiday — No class sessions	November	24
Week for second term tests	{ November 28 { December 3	
Final class session before Christmas recess	December	21

1961

First class session after Christmas recess	January	3
Final examinations, fall semester	January	23-28
Spring semester classes begin	February	6
Legal Holiday — No class sessions	February	22
Week of first term tests	March	6-11
Week of second term tests	April	10-15
Legal Holiday — No class sessions	April	19
Final examinations — spring semester	May	22-27
Legal Holiday — No class sessions	May	30
Summer session classes begin	May	29
Commencement	June	18
Summer session classes end	August	31

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- NORMAN CUTLER, B.S., Boston University
Tax Planning
 Internal Revenue Service
- PAUL A. DANIELSON, JR., B.S., University of Pennsylvania
Market Research, Sales Promotion
 Marketing Director, Cuticura Laboratories, Potter Drug & Chemical Corporation
- JOHN F. DARGIN, JR., LL.B., M.B.A., Northeastern University
Corporations, Partnerships and Agency; Freight Claims, Business Law
 Attorney at Law
- ARNOLD E. DAUM, B.S., Northeastern University
Techniques of Salesmanship, Marketing Management Seminar
 General Sales Manager, Usen Canning Company
- LAURENCE STROUT DAY, Ph.B., Brown University
Credit Fundamentals, Advanced Credits and Credit Problems
 Credit Manager, W. F. Schrafft and Sons Corporation
- LESTER DEARBORN, B.S., Boston University
Psychology of Personality
 Counseling Service, Boston Y.M.C.A.
- ROSSELL L. DERBY, B.B.A., Northeastern University; S.M., Massachusetts Institute of Technology
Retail Store Management, Retail Store Merchandising
 Director of Personnel and Labor Relations, William Filene's Sons Company
- ELLSWORTH F. DERTINGER, B.S., University of Alabama
Reliability Engineering
 Product Assurance Manager, Raytheon Company
- ALAN J. DIMOND, A.B., LL.B., Harvard University
Business Law
 Bernkopf, Goodman, Houghton, and Dimond
- CHARLES D. DONLEY, B.B.A., M.B.A., Northeastern University
Advanced Traffic Management, Rates and Tariffs, Ocean Transportation
 Tariff Analyst, New England Motor Rate Bureau, Inc.
- BEN G. DORAN, A.B., Washington and Jefferson
Claims Procedure
 Supervising Examiner of Property Loss, Liberty Mutual Insurance Company
- THEODORE S. D'ORLANDO, B.B.A., M.B.A., Northeastern University
Fire Insurance
 Production Administration and Co-ordination, Fairfield & Ellis
- STELIAN P. DUKAKIS, A.B., Bates College; M.A., Boston University
Political Parties and Politics
 Medford City Manager's Office
- W. JOHN DUNNAN
Real Estate Sales and Advertising
 President, Town and Country Homes, Inc.
- JAMES T. DUNPHY, Bentley School of Accounting & Finance
Cost Accounting
 Manager, Milk Accounting Division, H. P. Hood and Sons, Inc.
- WILLIAM H. DYKSTRA, B.S., Boston University; C.P.A.
Managerial Accounting
 Controller's Department, United Shoe Machinery Corporation
- MELVIN A. DYSON, B.B.A., University of Massachusetts; C.P.A.
Managerial Accounting
 Supervisor, Lybrand, Ross Bros. & Montgomery

- JAMES W. EARLEY, A.B., Holy Cross; B.S.Ed., Massachusetts State Teachers College; M.B.A., Northeastern University
Human Relations
 Director of Personnel Practices, Raytheon Company
- RAYMOND ELIOTT, Bentley School of Accounting & Finance; C.P.A.
Introductory Accounting, Intermediate Accounting
 Faculty, Becker Junior College
- WALTER M. ENNIS, S.B., Massachusetts Institute of Technology; M.B.A., Boston University
Wage Administration
 Personnel Manager, Raytheon Company
- MAURICE EPSTEIN, A.B., Harvard University; LL.B., Harvard Law School
Labor Legislation, Labor Relations Seminar
 Attorney at Law
- STANLEY EPSTEIN, A.B., LL.B., Harvard University
Contracts
 Attorney at Law
- HARRY B. ERNST, B.S., Boston College; A.M., Boston University; Ph.D., Harvard University
Business Economics
 Tufts University
- AUGUSTUS H. FENN, A.B., Bowdoin College; M.Ed., Ed.D., Wayne University
Psychology for Business
 Research and Writing
- RALPH E. FENTON, B.B.A., Northeastern University
Office Management Practices
 Office, Methods and Training Director, Factory Mutual Engineering Division
- RALPH W. FINGAR, B.S., Union College; Ph.D., University of Texas
Psychology, Man in Society
 Clinical Psychologist, Boston Veterans Administration Hospital
- ANGELO JOHN FIUMARA, A.B., LL.B., Boston College
Contracts, Law of Sales
 Attorney at Law
- ARTHUR J. FLAMM, B.S., Cornell University; LL.B., Harvard University
Labor Agreement
 Attorney at Law
- LEWIS MARTIN FLESHER, B.S., Columbia University
Principles of Salesmanship
 President, M. Fleisher, Inc.
- GEORGE HUTCHINSON FOLEY, A.B., LL.B., Harvard University
Labor Legislation
 Attorney specializing in Labor Relations Law
- GALE P. FOSTER, Boston University
Marketing
 Account Supervisor, Sutherland-Abbott Advertising Agency
- JAMES A. FOSTER, B.S., University of Pennsylvania
Insurance Principles
 Assistant Vice-President, Liberty Mutual Insurance Company
- HOWARD H. FREEDMAN, A.B., Colby College; M.S., Columbia University; C.P.A.
Managerial Accounting
 Staff, Coven and Suttenger
- FRANK J. GABLE, Boston University
Selling Transportation Services
 General Sales Manager, Cargo-Imperial Freight Lines, Inc.
- LORING E. GARRETT, Northeastern University
Punch Card Machine Methods
 Asst. Director of Machine Accounting, Savings Bank Life Insurance Council
- JOHN A. GEARY, B.S.Ed., Massachusetts State Teachers College
Industrial Safety
 Asst. Superintendent of Engineering, Employers' Group of Insurance Companies
- JOHN V. GIARRATANA, Northeastern University
Air Cargo Transportation
 Specialist, Administrative Services, American Airlines, Inc.

- CLEVELAND GILCREAST, B.S., M.B.A., Harvard University
Marketing
 General Manager, Foods Division, H. P. Hood and Sons, Inc.
- WILLIAM F. GLASER, JR., B.Mgt. Eng., Rensselaer Polytechnic Institute; S.M., Massachusetts Institute of Technology
Financial Policies and Planning
 Personnel Manager, H. H. Scott, Inc.
- SHIRLEY GODLEY, A.B., Bates College; M.A., Columbia University
India and the Far East
 Doctoral Candidate, Harvard University
- BERNARD P. GOLDSMITH, B.S., University of New Hampshire; M.A., Boston University
Industrial Experimentation
 Northeastern University
- JOHN J. GRAHAM, A.B., M.A., Yale University; A.M., Boston University; LL.B., Boston College; M.ASTT.
Government Controls in Business, Advanced Transportation Economics
 Attorney at Law
- DOUGLAS A. GREEN, Ph.B., M.B.A., Brown University
Production Planning and Control
 Management Consultant
- HOWARD FRANCIS GREENE, Northwestern University; C.P.A.
Advanced Accounting Problems, C.P.A. Problems
 Chairman, Accounting Department, University College
 Principal, J. K. Lasser & Company
- MYRON GREENSIDE, B.S., Boston University; LL.B., Northeastern University; C.P.A.
Taxation
 Tax Accountant, Starr, Finer Starr and Company
- THOMAS G. GROGAN, Northeastern University
Manufacturing Management Seminar
 Specialist, Organization Control and Program Planning, General Electric Company
- STERLING B. HAGER, Northeastern University
Time Study
 Plant Engineer, Fenwal Laboratories, Inc.
- E. FOREST HALLET, B.S.E., Fitchburg State Teachers College
Effective Speaking for Business
 Northeastern University
- RAYMOND F. HAMEL, LL.B., Boston University
Advertising Principles, Advertising Copy
 Promotion Director, Cahners Publishing Company, Inc.
- DAVID J. HARRIGAN, B.A., Boston College
Quality Control in Industry
 Plant Quality Control Supervisor, Raytheon Company
- RAYMOND A. HARRIMAN, General Electric School; Boston University
Job Analysis and Evaluation
 Manager, Personnel Relations, Small Aircraft Engine Department, General Electric Company
- HUGH HEALEY, S.B., Massachusetts Institute of Technology
Work Simplification
 Specialist, Manufacturing Engineering, General Electric Company
- THOMAS CARROLL HEFFERNAN, A.B., A.M., Boston College; LL.B., Northeastern University
Business English
 Administrative Assistant to Superintendent, Boston School Department
- ROBERT J. HEHRE, B.S., M.S., Columbia University
Financing Business Operations
 Assistant Manager, Discount and Credit Department, Federal Reserve Bank of Boston
- FRANKLIN C. HEINEMANN, A.B., Dartmouth College; M.A., Fletcher School-Tufts University
Business Economics
 Administrative Assistant, General Radio Company

- ROBERT G. HENNEMUTH, A.B., Syracuse University; LL.B., Harvard University
Corporations, Partnerships and Agency
Director of Labor Relations, Raytheon Company
- WILLIAM S. HERTZMARK, S.B., Massachusetts Institute of Technology
Quality Control in Industry
Department Head, Quality Control Engineering, Microwave and Power Tube Division,
Raytheon Company
- CHESTER W. HIGGINS, B.B.A., Northeastern University
Personnel Management Practices
Assistant Vice-President and Personnel Director, American Mutual Liability Insurance
Company
- GORDON C. HILL, B.S., American International College, C.P.A.
Managerial Accounting
Technical Advisor, Appellate Division, Internal Revenue Service
- FREDERICK C. HOLLAND, B.S., Boston University
Real Estate Finance
Vice-President and Mortgage Officer, Dorchester Savings Bank
- VICTOR E. HOWES, A.B., Harvard University; M.A., University of Connecticut; Ph.D., Yale
University
Business English
Northeastern University
- GRATON G. HOWLAND, B.S., M.S., Boston University
Math. for Business
Instructor, North Quincy High School
- DANIEL F. HURLEY, A.A., LL.B., Northeastern University
Labor Agreement
Commissioner, Federal Mediation and Conciliation Service
- MELVIN C. JACK, B.S., M.S., University of Massachusetts
Managerial Accounting, Accounting Problems
Head of Business Education Department, North Quincy High School
- PHILLIP S. JACKSON, S.B., LL.B., Harvard University
Contracts, Business Law
Attorney at Law
- DALE W. JOHNSON, B.B.A., University of Minnesota; C.P.A.
Managerial Accounting
Vice-President and Treasurer, Bondified Systems, Inc.
- ROBERT E. JOHNSON, B.S., Boston University
Internal Auditing
Supervisory Auditor, Raytheon Company
- JOHN H. JUDGE, B.B.A., M.Ed., Boston University
Psychology
Executive Director, Beaverbrooke Academy, Inc.
- LOIS KACHENMEISTER, B.S., M.Sc., University of Toledo; M.D., Ohio State University
Anatomy
Cambridge City Hospital
- HYMAN MENDEL KAUFMAN, S.B., Boston University; M.A., Columbia University; LL.B.,
Harvard University
Business Law, Creditors' Rights
Attorney at Law
- RICHARD A. KAYE, A.B., LL.B., Harvard University
Business Law
Attorney at Law
- PAUL F. KEATING, Bentley School of Accounting & Finance; B.B.A., Northeastern University;
C.P.A.
Managerial Accounting
Controller, H. H. Scott, Inc.
- DAVID A. KELLNER, Northeastern University
Advertising Principles
Vice-President and Director of Sales and Advertising, Kellner System; President and Treas-
urer, Wilton-Greene Corporation

- ARNE J. KORSTVEDT, A.B., M.A., Syracuse University
Psychology for Business
 Psychologist, Judge Baker Guidance Center, Cape Cod Guidance Center
- PAUL D. KRENSKY, B.S., Tufts University; M.S., Syracuse University
Quality Control
 Quality Control Consultant, L. A. Seder & Associates
- KENNETH W. LAMPREY, Bentley School of Accounting & Finance; B.B.A., Northeastern University
Analysis Financial Statements, Constructive Accounting
 Controller, A. B. Sutherland Company
- THOMAS S. LESTER, A.B., Harvard College
Literature
 Eastern Gas & Fuel Associates
- ABRAHAM HYMAN LEVINE, B.S., Tufts University
Work Simplification
 Industrial Engineer, General Electric Company
- HAROLD LEVINE, B.S., LL.B., Boston University; C.P.A.
Managerial Accounting
 Public Accountant and Attorney at Law, in practice as Principal
- JOHN LIGHT, B.A., Williams College
Foreign Trade
 Supervisor, Foreign Market Research, The First National Bank of Boston
- HAROLD LIST, B.S., College of the City of New York; M.A., Columbia University
Career Planning
 B'nai B'rith and Jewish Vocational Service
- BENJAMIN ABBOTT LITTLE, A.B., University of Pennsylvania; Ed.M., Boston University
Business English
 English Department, Gloucester High School
- GEORGE B. LOURIE, A.B., LL.B., Harvard University
Tax Planning
 Attorney at Law
- EDWIN H. LOVEQUIST, JR., B.S., Northeastern University
Production Planning and Production Control
 Specialist, Production Control, General Electric Company
- EDMUND M. MACCLOSKEY, A.B., Bowdoin College; A.M., Boston University
Effective Speaking for Business, Business English
 Modern Languages, Winchester High School
- JAMES MAHONEY, B.A., Harvard; Ph.D., Boston University
Man in Society
 Brockton V. A. Hospital
- JOSEPH E. MAHONEY, B.B.A., Northeastern University
Production Processes
 Master Mechanic, Boston Naval Shipyard
- LAWRENCE HOWARD MALCHMAN, B.S., B.A., Ed.M., Boston University; C.P.A.
Managerial Cost Control, Financial and Administrative Accounting
 Northeastern University
- ERNEST MANCHIN, B.B.A., Boston University
Insurance for Management
 Assistant Superintendent of Education Department, Employers Group of Insurance Companies
- JOHN E. MARSHALL, B.S., Northeastern University
Production Control
 Industrial Consultant
- GEORGE M. MCCOLGAN, B.S., M.S., Calvin Coolidge College
Basic Technology for Production
 Boston Trade High School
- J. FORD MCGOWAN, Ph.B., Providence College; Harvard University
Marketing
 President, Ford McGowan Associates

- JAMES R. MCGOWAN, A.B., Providence College; LL.B., Harvard University
Income Tax Procedure
 Attorney at Law, Salter & McGowan
- THOMAS J. MCHUGH, B.S., Bowling Green University; M.B.A., Harvard University
Financing Business Operations
 Franchised Agent, Josten's
- JAMES A. McLAUGHLIN, A.B., Harvard University; Ed.M., Boston University
Business English
 Counselor, Gorton Junior High School, Warwick, R. I.
- JOHN F. McLAUGHLIN, B.L.I., Emerson College; Ed.M., Boston University; Harvard University
Business English
 Winchester High School
- THOMAS J. McNAMARA, B.S., Massachusetts Institute of Technology, Northeastern University
Electronic Data Processing
 Staff Assistant, Datamatic, a Division of Minneapolis-Honeywell Regulator Company
- CHARLES A. McNEIL
Techniques of Supervision
 Metal Hydrides, Inc.
- HERBERT MELLO, Bentley School of Accounting & Finance
Punch Card Accounting
 Analyst, Electronic Data Processing, Raytheon Company
- ROBERT E. MERRILL, B.S., Harvard University
Financing Business Operations
 Commercial and Industrial Loan Department, Prudential Insurance Co. of America
- ALBERT R. MEZOFF, B.S., University of Massachusetts; LL.B., Harvard Law School
Business Law
 Attorney at Law
- GERALD E. MILES, B.S., Washington Missionary College; A.M., Boston University; Ed.M., Harvard University
Employment Testing
 Personnel Consultant
- CEDRIC B. MINAS, LL.B., LL.M., Boston University
Business Economics, Negotiable Instruments, Creditors' Rights
 Attorney at Law
- ROBERT C. MISCH, B.S., M.A., Boston University; Ph.D., Clark University
Man in Society
 Boston V. A. Hospital
- LESLIE B. MORASH, B.S., M.B.A., Boston University
Commercial Warehousing
 President and General Manager, Service Warehouse Company
- THOMAS A. MORSE, B.S., M.S., Boston University
English
 Assistant Principal, Winchester High School
- JOHN J. MULKERIN, JR., A.B., St. John's University
Techniques of Supervision
 Personnel Manager, Walter Baker Division, General Foods Corporation
- PAUL V. MULKERN, A.B., M.S., Boston College, Harvard University
Labor-Management Relations
 Wage Analyst, United States Department of Labor
- JOSEPH A. MULLEN, B.B.A., M.B.A., Northeastern University
Business Conferences
 Boston Naval Shipyard
- KENDALL B. MURRAY, B.S., University of New Hampshire; C.P.A.
Fund Accounting, Financial & Administrative Accounting
 Supervisor, Lybrand, Ross Bros. & Montgomery
- A. HOWARD MYERS, A.B., Cornell University; M.A., Ph.D., Columbia University
Labor Relations Seminar
 Northeastern University; Labor Arbitrator

- THEODORE H. NEEDLE, B.B.A., Boston University; C.P.A.
Managerial Accounting, Accounting Problems
Partner, Penn and Needle, Certified Public Accountants
- WILLIAM C. NEMITZ, JR., B.S., Massachusetts Institute of Technology; M.B.A., Northeastern University
Production Planning and Control
Manager, Manufacturing Planning, Westinghouse Electric Corporation
- RICHARD W. NEWMAN, A.B., Ph.D., Boston University; M.Ed., Boston Teachers College
Russian
Boston State Teachers College
- FRANKLIN NORVISH, B.S., Colby College; M.A., Yale University
Business English
Northeastern University
- FLETCHER F. OAKES, JR., Northeastern University
Human Relations
Assistant Director of Marketing, H. P. Hood and Sons, Inc.
- ROBERT M. O'BRIEN, Boston University
Electronic Data Processing - Programming
Assistant to Director, Computation Center, Northeastern University
- EDWARD T. O'DONNELL, B.C.S., New York University; M.B.A., Boston University
Business Statistics
Regional Manpower and Employment Analyst, U. S. Bureau of Labor Statistics
- THOMAS B. O'HEIR, B.S., Boston College
Electronic Data Processing for Business
Systems Analyst, Minneapolis-Honeywell Regulator Company
- THOMAS A. O'KEEFE, A.B., A.M., Boston College; Ed.M., Boston Teachers College
English, American History
Brighton High School
- HARRY OLINS, A.B., LL.B., Harvard University
Business Law, Contracts
Attorney at Law
- JOHN L. OLSEN, JR., S.B., Massachusetts Institute of Technology
Office Management Practices
Assistant Director, Methods Department, Liberty Mutual Insurance Company
- RICHARD C. OLSON, B.S., Worcester Polytechnic Institute; M.B.A., Northeastern University
Statistics
Manager, Reliability Department, Laboratory for Electronics
- LOUIS J. O'MALLEY, B.S., Massachusetts Institute of Technology; LL.B., Boston College
Business Law
Self-employed
- LESTER J. O'NEILL, A.M.E., B.B.A., Northeastern University
Work Simplification I
Manufacturing Superintendent, General Electric Company
- J. ROSSON OVERCASH, B.A., A.M.T., Harvard University
Man's Physical Universe
Northeastern University
- GEORGE PALKEN, S.B., Tufts University
Principles of Production Planning
Vice-President, Benwill Publishing Corporation
- STEVEN A. PARKS, B.S., Carnegie Institute of Technology
Work Simplification
Production Superintendent, Monsanto Chemical Company
- FRANK T. PARRISH, JR., B.S., M.B.A., Boston University
Financial Policy and Planning, Investment Principles
Investment Analyst, Fidelity Management and Research Company
- R. THOMAS B. PERCE, JR., A.B., Williams College; B.S., Massachusetts Institute of Technology
Principles of Distribution
Staff Assistant, Industrial Sales, Polaroid Corp.

- BENJAMIN M. PERLES, B.S., Northeastern University, M.B.A., Boston University
Business Statistics, Financial Policy and Planning
Northeastern University
- GEORGE G. PIERCE, A.B., Amherst College; LL.B., Columbia University
Business Law
Attorney at Law
- FRANK R. PORTER, B.S., Colby College; Ed.M., Harvard University
Speed and Comprehension in Reading
Northeastern University
- GERALD G. PORTNEY, B.S., Boston University
Basic Federal Taxes
Internal Revenue Agent, Internal Revenue Service
- EDWARD J. POWERS, B.B.A., M.B.A., Northeastern University
Business Conferences
Master Electronics Mechanic, Boston Naval Shipyard
- W. JAMES RALEIGH, B.S., Seton Hall University
Principles of Salesmanship
District Sales Manager, Chicopee Mills, Incorporated
- W. ARTHUR REYNOLDS
Small Home Construction and Estimating
Head, Building Construction Department, Wentworth Institute
- WILLIAM HOOPER REYNOLDS, S.B., A.M., Harvard University
Business English
Northeastern University
- LOUIS ROBERTS, A.B., Bowdoin College; M.A., Boston University
English
Northeastern University
- STANLEY O. ROBINSON, B.S., Tufts University
Time Study
President, Robinson Associates, Industrial Consultants
- FREDERICK ROGERS, LL.B., Northeastern University
Credit Fundamentals
Credit Manager, Allied Plywood, Inc.
- PAUL B. ROSENBERG, A.B., Tufts University; M.B.A., Harvard Business School
Financing Business Operations
Consolidated Bag & Foil Corporation
- ALBERT H. ROSS, B.S., University of Massachusetts; LL.B., Boston University
Labor Legislation - Standards and Conditions
Attorney, U. S. Department of Labor
- GERALD R. RUBIN, B.B.A., Northeastern University
Managerial Accounting
Partner, Greene, Engleman & Rubin
- JAMES J. RYAN, A.B., Queens College; M.A., Ph.D., Wisconsin University
Spanish
Northeastern University
- THADDEUS SADOWSKI, S.B., Massachusetts Institute of Technology; Ed.M., Boston University
Mathematics for Business
North Quincy High School
- ALBERT P. SAGANSKY, A.B., Clark University
Motor Carrier Operations
President, Boston and Taunton Transportation Company
- CHARLES L. SAKAY, A.B., Boston University; M.A., Boston University
Modern Languages, English
Boston Latin School
- RICHARD J. SANTOS, B.S., Salem Teachers College; M.A., Emerson College
Effective Speaking
Northeastern University

- DAVID M. SCHEFFER, A.B., University of Chicago; J.D., University of Chicago
Basic Federal Taxes
Widett & Kruger
- RICHARD L. SCHOENWALD, A.B., Syracuse University; A.M., Ph.D., Harvard University
Introduction to Literature
Massachusetts Institute of Technology
- HERBERT J. SCHWARTZ, B.S., University of Buffalo; Advanced Management Program, Harvard
Graduate School of Business Administration
Sales Executive Training
Assistant Vice-President, Liberty Mutual Insurance Company
- DANIEL C. SCIOLETTI, B.B.A., Colby College; M.Ed., Boston University; LL.B., Suffolk
University
Managerial Accounting
Northeastern University
Attorney at Law
- WILLIAM J. SCOTT, B.S., Babson Institute
Financial Policy and Planning
Results Accountant, New England Telephone & Telegraph Company
- HENRY W. SEAFORD, JR., A.B., Wheaton College
American Culture
Doctoral Candidate, Harvard University
- LEONARD AVERN SEDER, S.B., Massachusetts Institute of Technology
Quality Control, Advanced Quality Control, Management of Quality Control
Quality Control Consultant
- DONALD SEGAL, Boston University
Principles of Salesmanship, Sales Management
Sales Manager, Cupples Envelope Company
- JULIUS L. SHACK, A.B., LL.B., Harvard University
Business Law
Attorney at Law
- SAMUEL SHAPIRO, A.B., Tufts University; M.B.A., Harvard University; C.P.A.
Financial Policy and Planning, Financing Business Operations
Industrial Consultant, Public Accountant, in practice as Principal
- JAMES F. SHARKEY, Boston University
Ocean Transportation
Sales Representative, Pan-Atlantic Steamship Corporation
- ARTHUR SHERMAN, A.B., LL.B., Harvard University
Contracts
Attorney at Law
- VINCENT SILLUZIO, B.S., Ed.M., Boston University
Man's Physical Universe
Newton High School
- ALBERT J. SIMONE, B.A., Tufts University
Business Economics
Instructor, Massachusetts Institute of Technology
- LOYD A. SKIFFINGTON, B.A., University of Maine; A.M., Harvard University
Business English
Northeastern University
- JOSEPH SKINNER, A.B., M.A., Ph.D., Harvard University
History of Civilization
Massachusetts College of Pharmacy
- HASSELL B. SLEDD, B.A., M.A., University of North Carolina
English
- MAURICE E. SMITH, A.B., LL.B., Harvard University, C.P.A.
Estate Planning - Tax Aspects
Attorney at Law; Partner, Waldron H. Rand and Company
- ALLAN SPACK, LL.B., Northeastern University
Contracts, Negotiable Instruments, Creditors' Rights
Attorney at Law

- GORDON L. SPANGLER, A.B., Tufts University; M.A., Fletcher School - Tufts University
Business Planning and Research
 Business Analyst, The First National Bank of Boston
- BENJAMIN FRANKLIN STACEY, A.B., Dartmouth College; M.C.S., Amos Tuck School
Business Planning and Research
 Vice-President, The First National Bank of Boston
- FRANCIS C. STACEY, JR., A.B., Harvard University; M.B.A., Harvard Business School
Production Planning and Control
 General Analyst, American Mutual Liability Insurance Company
- JOSEPH V. STANFORD, LL.B., Boston College
Casualty Insurance
 Superintendent - Education Department, Employers Liability Assurance Corporation
- FRANK A. STICKNEY, B.S., Boston University; U.S.A.F. Institute of Technology
Statistics
 Captain, U.S.A.F., Boston Air Procurement District
- ROBERT C. STORY, George Washington University
Practical Training Methods
 Training Programs Co-ordinator, Raytheon Company
- EARLE B. SUKEFORTH, B.S., Bridgewater Teachers College
Supervisor of Instruction
 Manager, Specialized Personnel Services and Director of Training, H. P. Hood and Sons, Inc.
- JOHN E. SULLIVAN, A.B., Boston College; Ed.M., Boston University
Marketing, Practical Training Methods, Techniques of Supervision
 Regional Training Director, Internal Revenue Service
- HARRY C. TAFT, JR., Bentley School of Accounting & Finance
E.D.P. for Business
 Data Processing Analyst, General Electric Company
- MARTIN S. TAGERMAN, LL.B., Northeastern University
Principles of Salesmanship
 Divisional Sales Manager, H. P. Hood and Sons, Inc.
- R. C. WILLIAM THELEN, Massachusetts Institute of Technology
Job Analysis and Evaluation, Scientific Management in Office Practice
 Wage and Salary Adm., River Works, General Electric Company
- PAUL E. TIERNEY, Bentley School of Accounting & Finance; C.P.A.
Internal Auditing
 Second Vice-President and Auditor-Research, John Hancock Mutual Life Insurance Company
- ROY M. TOLLEFSON, B.A., B.S., University of Minnesota; A.M., Columbia University;
 Ph.D., University of Chicago
Soviet Union, International Relations, American Foreign Policy, Modern Political Theory
 Simmons College
- BERNARD A. TORRI, B.B.A., Northeastern University
Business Organization and Administration
 Co-ordinator, Boston Insurance Group
- JOHN A. TYRELL, JR., B.S., Boston College; M.S.Ed., Boston Teachers College; Ed.D., Boston University
Man's Physical Universe
 Charlestown High School
- WILLIAM O. URANECK, A.B., Olivet, Mich.; M.P.A., University of Michigan
Business Conferences, Creative Thinking
 Training Supervisor, Semiconductor Division, Raytheon Company
- JOSEPH A. VACCARO, B.A., Northeastern University; M.S., Boston University
Business English
 Northeastern University
- RICHARD VALLON, D.S.C., Middlesex University
Management of Personal Finance
 Sales Representative, Hooper-Kimball, Inc.

ERWIN VON ALLMEN, B.A., University of Connecticut; M.A., Williams College; M.B.A., Harvard University
Principles of Distribution
 Staff Consultant, Arthur D. Little, Inc.

MARK WAINER, LL.B., LL.M., Boston University
Business Law; Corporations, Partnerships and Agency
 Attorney at Law

FRANK J. WEINER, B.S., Boston University
Motor Carrier Traffic Management, I.C.C. Practices and Procedures, Transportation Practices, Traffic Management
 Transportation Consultant, Francis E. Barrett

ROBERT L. WELLS, B.S., Tufts University; M.A., Boston University, Boston Museum School of Fine Arts
Man's Cultural Inheritance
 Northeastern University

ROBERT GEORGE WERTHEIMER, A.B., Rainer Real Gymnasium; M.B.A., Old Academy, Vienna; Ph.D., Vienna University; M.A., Ph.D., Harvard University
Economic Geography, International Economics
 Babson Institute

ORVILLE F. WESTOVER, B.B.A., M.B.A., Northeastern University
Office Systems and Procedures, Forms Design and Control
 Comptroller, Faulkner Hospital

KENNETH P. WHITE, B.S., Northeastern University; Ed.M., Boston University
Business Economics
 Newton Junior College

ALBERT J. WILDE, B.S., Columbia University
Material Handling - Problem Analysis
 Department Head, Technical Service, Western Electric Company

WILLIAM M. WILLIITS, B.B.A., M.B.A., Northeastern University; R.P.E., Massachusetts
Materials Handling Fundamentals
 Department Chief, Manufacturing Engineering, Western Electric Company, Inc., North Andover, Mass.

STEPHEN S. WU, B.A., St. John's University; M.A., Stanford University; A.M., Columbia University; M.B.A., Northeastern University
Financial Policy and Planning
 Senior Investment Analyst, Old Colony Trust Company

ARNOLD M. ZACK, A.B., Tufts University; LL.B., Yale University
Labor-Management Relations
 Arbitrator

Northeastern University

General Statement

AIMS AND SCOPE OF THE UNIVERSITY

Founded in 1898, Northeastern University is incorporated as a privately endowed non-sectarian institution of higher learning under the General Laws of Massachusetts. The State Legislature by special enactment has given the University general degree granting powers. The University is governed by a Board of Trustees who are elected by and from the Northeastern University Corporation which is comprised of more than a hundred distinguished business and professional men.

From its beginning Northeastern University has had as its dominant purpose the discovery of community educational needs and the meeting of these in distinctive and serviceable ways. The University has not duplicated the programs of other institutions, but has sought to pioneer new areas of educational service.

A distinctive feature of Northeastern University is its Co-operative Plan, initiated by the College of Engineering in 1909 and subsequently adopted by the Colleges of Business Administration (1922), Liberal Arts (1935), and Education (1953). This serviceable educational method enables students to gain valuable practical experience as an integral part of their college programs and also provides the means by which they may contribute substantially to the cost of their education. The plan has been extended to the graduate level in several fields of engineering in co-operation with industrial corporations located throughout the United States.

In the field of adult education, programs of study have been developed to meet a variety of needs. Since 1906 evening curricula have been offered leading to the bachelor's degree in business and carefully planned to serve mature students who are employed full time during the day but who are desirous of broadening their educational background by part-time study. Similar evening programs in the arts and sciences, in engineering, and in teacher education have been added in recent years. All formal courses of study leading to degrees through evening programs are approved by the appropriate college faculty and are subject to the same quantitative and qualitative standards as the regular day curricula.

The following is a brief outline of the aims and scope of the University's programs.

I. The Five Colleges

1. *The College of Liberal Arts*

The College of Liberal Arts offers majors in the usual fields of the arts and sciences leading to the degrees of Bachelor of Arts and Bachelor of Science. With the exception of pre-professional programs, day curricula are normally five years in length and operated on the Co-operative Plan. In all majors except chemistry and physics, however, qualified students with the approval of the Dean may elect to complete requirements for the degree on a full-time plan in four years. The College also offers a number of its courses

during evening hours, constituting a program leading to the Bachelor of Arts degree with curricula in economics, English, history and government, and sociology.

2. *The College of Education*

The College of Education offers the option of study on the conventional four-year full-time plan or on the five-year Co-operative Plan which provides for a period of teacher-internship in various school systems of the Greater Boston area. Both programs lead to the degree of Bachelor of Science in Education and are designed particularly to meet the needs of high school graduates who desire to prepare themselves for teaching or administrative positions in elementary and secondary schools.

The College also offers evening curricula leading to the degree of Bachelor of Science in Education in co-operation with the College of Liberal Arts.

3. *The College of Business Administration*

The College of Business Administration offers both day and evening programs of study in the principal fields of business leading to the degree of Bachelor of Science in Business Administration. The day programs are offered on the five-year Co-operative Plan under which students gain substantial practical experience in the fields for which they are preparing as an integral part of their undergraduate course of study.

Evening programs offered by the College meet the same academic requirements as the day curricula and lead to the same degrees. The evening programs of part-time study normally extend over approximately eight years.

4. *The College of Engineering*

The College of Engineering offers five-year co-operative curricula in civil, mechanical, electrical, chemical, and industrial engineering leading to the degree of Bachelor of Science with specification according to the engineering department in which the student qualified.

The College also offers during evening hours a full program leading to the degree of Bachelor of Science in Electrical Engineering. This program extends over nine years, covers the identical courses given in the day co-operative curriculum, and meets the same qualitative and quantitative standards of scholarship.

5. *University College*

University College, so called because it draws upon the resources of the other Colleges of the University, offers courses of study leading to certificates, associate degrees, or to Bachelor of Science degrees. Programs of the College are designed specifically to meet the needs of older, more mature students who wish to undertake part-time programs of education during evening hours.

Quality standards of instruction and the requirements for its degree are wholly consistent with those of the other Colleges of Northeastern University. University College does not duplicate the offerings of the Colleges of Liberal Arts, Business Administration, Education, and Engineering, but provides curricula which cut across traditional subject matter areas and meet the particular needs of adults desiring formal programs of professional development on a part-time basis.

II. The Graduate School

The Graduate School of the University offers day and evening programs of study leading to appropriate masters degrees in the fields of arts and sciences, education, business, and engineering. Some of these programs are offered on the Co-operative Plan; others provide teaching and research fellowships for able candidates. Administrative headquarters for all graduate programs are located on the first floor of the Graduate Center Building where the offices of the Dean and of the several directors of professional programs are located.

III. Lincoln Institute

Lincoln Institute offers evening programs of study in several fields of science and engineering technology leading to the degree of Associate in Science or Associate in Engineering. The courses of study are of college grade and cover much of the technological subject matter customarily included in schools of engineering, but the curricula are less extensive in scope than those required for the baccalaureate degree in engineering. They prepare students to work with professional engineers in various technical capacities.

IV. Adult and Continuing Education

The Office of Adult and Continuing Education develops and offers special educational programs and services for the civic, business, and industrial community. These include the Bureau of Business and Industrial Training, which provides both off-campus and in-plant programs custom-built to serve specific training needs; the Department of Special Programs, which offers on-campus courses, seminars, conferences, and forums — usually co-operatively with professional societies, trade associations or civic agencies — to communicate information about current trends and the on-going needs of a changing society.

V. Research Activities

The faculty of the University are engaged upon a wide variety of basic research projects in business, science, social science, and engineering. These are co-ordinated by the Dean of Research Administration whose services are University-wide and available to the faculties of all the Colleges.

Although Northeastern is primarily concerned with undergraduate and graduate instruction in the areas of arts and sciences, business, engineering, and teacher education, the University believes that the most effective teaching and learning takes place in an environment characterized by research activities directed toward extending the frontiers of knowledge.

BUILDINGS AND FACILITIES

University Buildings

LOCATION

Northeastern University is located on Huntington Avenue, Boston. The main administrative offices of the University are located in Richards Hall.

The chief railroad centers of Boston are the North and South Stations. To reach the University from the North Station, board an MTA subway car going to Park Street and transfer there to any Huntington Avenue car. To reach the University from South Station, board a Cambridge-bound subway train and transfer at Park Street to a Huntington Avenue car. The "Northeastern" station is the first stop outside the subway.

HUNTINGTON AVENUE CAMPUS

The principal educational buildings of Northeastern University are located on a sixteen-acre site in the Back Bay section of Boston. Only one block to the west of the University lie the famous Boston Museum of Fine Arts and the beautiful public gardens park reservation known as "The Fenway."

Following a long-range development plan, University facilities have expanded substantially in recent years. In addition to the seven buildings constructed within the last two decades, several modernized older buildings are available for specialized uses. The newer buildings on the campus are interconnected by means of tunnels, so that the students may go from building to building without going out of doors in inclement weather.

In addition to classrooms and instructional offices, the principal buildings include the following:

Botolph Building — Civil Engineering laboratories

Forsyth Building — Industrial and Mechanical Engineering laboratories

Greenleaf Building — ROTC headquarters, research facilities

The Robert Gray Dodge Library — Library, drawing rooms

Science Hall — Chemical Engineering and Biology laboratories

The Carl Stephens Ell Student Center — Student Activities, Health Department, chapel, auditorium, and University Commons

Richards Hall — Administrative offices, Mechanical Engineering, Psychology and Chemistry laboratories, bookstore

The Godfrey Lowell Cabot Physical Education Center — gymnasium, cage, rifle range

Hayden Hall — Evening Division offices, Business, Education, and Electrical Engineering laboratories, art studio

Graduate Center — Administrative offices of the Graduate School, Physics laboratories and cafeteria

University College

The Philosophy of University College

The establishment of University College in 1960 as the fifth College in the Northeastern University system, with academic programs designed especially for adults, represents a pioneering move in American education. It represents Northeastern University's commitment to the philosophy of higher education for adults, which recognizes that the true function can be achieved only if the characteristics which differentiate the mature adult can be reflected in the course design and methodologies of instruction and administration.

It recognizes the true significance of the factors inherent in education for adults — that, through knowledge and understanding gained through work and life experiences, the adult brings to the classroom ingredients of maturity, earnestness of purpose and understanding evolving out of a strong vocational orientation which places special demands upon education.

It recognizes that education, to be truly realistic in serving the needs of adults, must be flexible, unrestricted by traditional approaches, and accepts one's total education as resulting from many contributing factors. University College in drawing from the full resources of the University colleges will cut across traditional educational patterns as it interprets special and changing needs and reflects them in forward-looking programs.

Education that truly serves the mature man or woman while based upon sound fundamentals must dig beneath the surface for supporting details — must relate generalities of subject matter to the reality of actual practice. The background of understanding of the mature student makes such teaching possible and meaningful. There are many *plus values* which are possible in adult education truly conceived.

Staff of Instruction

The teaching staff of University College, in addition to representing all colleges of Northeastern University, is also recruited from business and professional leaders of New England. Adults are demanding of their teachers in professional competence, ability to communicate, and friendliness of attitude. The faculty have proved their ability in their various fields of specialization and are selected on the basis of their ability to impart knowledge to others in an interesting, inspiring, and effective manner, drawing upon rich backgrounds of training and experience.

The Student Body

The cross section of the student body populating University College represents a heterogeneity of backgrounds and interests which properly recognized and utilized becomes one of the basic strengths in adult education.

The evening college student as a mature person — with real life problems — demands an educational pattern that is closely attuned to his professional advancement. His individual needs will vary from a specific course to a full degree curriculum.

With a specific commitment to education for mature adults, it is planned that those more recently graduated from high school would pursue traditional

programs in the other colleges. This makes possible in University College a greater degree of homogeneity, resulting in higher concentration on the needs of the adults.

With a broad age range, the average age approximates thirty; about two-thirds of the students are married men who have realized that positions of increased responsibility require advanced preparation. This has been conclusively proved by a study which showed substantial increases in income during the period of attendance.

Placement Service

For Students

Many requests from employers are received by the College, during normal times, for young men and women of potential ability to fill important positions of responsibility. It is the policy of the College to serve the students whenever possible by placing them in those positions which promise attractive opportunities for development and advancement. The College, however, cannot guarantee to place its students, but it does endeavor to keep in close touch with those who desire placement service and to assist them in obtaining satisfactory advancements in positions and income. No charge is made for placement service. Those needing this assistance should arrange an appointment with the Director of Placement and Guidance.

For Graduates

While the College cannot guarantee positions to its graduates, the number of requests for men usually exceeds the number available in the graduating class of any given year. The policy of the College is to find the best equipped and qualified men and women among its graduates for the positions which the College is called upon to fill.

The College in recommending a graduate for a position furnishes the prospective employer with the facts as to the graduate's ability, character, attitudes, habits, and other qualifications for the position as revealed by the College records. In the last analysis, however, placement in a position depends quite largely upon the graduate's ability to sell his services to the prospective employer. Most employers prefer to consider two or more candidates for a position and generally request the College to suggest more than one person. Many manufacturing and commercial firms throughout New England call upon this College to assist them in filling important executive and managerial positions.

No charge is made for placement service.

University College

Administrative Policies

Requirements for Admission

All applicants whose credentials are approved by the Committee on Education are admitted as regular or special students.

Regular Students

Applicants for admission as regular students must present evidence of the completion of an approved secondary school course, or the equivalent 15 units.*

Matriculation as a Degree Candidate

The procedure of formal matriculation as a degree candidate is deferred to provide the student ample opportunity to:

- (1) Become adjusted to the conditions of evening study and appreciate and accept the requirements of self-discipline necessary for successful scholastic achievement.
- (2) Determine under qualified guidance his major potentials translated into his major field of professional interest.
- (3) Demonstrate to his own satisfaction as well as to the College administration his ability to meet the standards established for all degree recipients.

The conditions for admission to degree candidacy are as follows:

- (1) The student will officially petition the faculty for admission to the status of a degree candidate. A five-dollar matriculation fee will accompany the petition.
- (2) The student will have completed no less than 30 semester hours of work in University College.
- (3) Included in the 30 semester hours of course credit, the student must have satisfactorily completed the foundation courses in the fields of English, accounting, economics and mathematics.
- (4) The student must achieve a cumulative average of 2.00 on a numerical equivalency basis for all courses completed prior to filing his petition.
- (5) Evidence of probable academic success will be demonstrated through an educational qualification test administered by University College.

Special Students

Applicants whose needs and interests can be best served through enrollment in one or more courses or in a certificate program may be admitted as special students provided they satisfy the admission requirements for regular students or the equivalent in training and experience as evidence of their probable success and their ability to profit by the courses.

*A unit represents a year's work in any subject in any approved secondary school constituting approximately a quarter of a full year's work, or the equivalent. A four-year day high school course is regarded as representing at least 15 units of work, or 3 units in junior high school and 12 units in a three-year senior high school.

Registration

Before attending classes, students must report to University College Office for registration. Registrations will be accepted beginning May 1st for the following College year. Applicants are requested to register during the summer months to lessen the congestion during the opening week. No student will be allowed to register for any course after the second session without special permission from the Dean.

A schedule of classes may be obtained by applying at the University College Office.

Remedial Courses

Satisfactory achievement in the degree curricula is predicated on a basic knowledge of English and mathematics. Every student enrolling as a degree candidate must demonstrate a proficiency in diagnostic tests in each of these fields.

Remedial courses will be provided by University College for those needing additional preparation or refresher instruction in these areas. These courses will be offered during summer terms or prior to the regular class sessions during the regular academic year. Remedial courses will not carry degree credit.

Transfer Students and Advanced Standing Credit

Advanced standing credit in the College may be obtained in one or both of two ways as follows:

By Transfer of Credit. Subject to the approval of the Committee on Education, credit may be given for work completed in other approved schools, colleges and universities. An applicant desiring credit by transfer should indicate his desire at the time of filing his application for admission. The applicant should instruct the Registrar of the institution of previous attendance to mail an official transcript direct to University College indicating honorable dismissal, courses completed, credits and grades.

By Examination. 1. For credit: No advanced standing credit is awarded except for work previously completed in courses comparable to those offered in University College or compatible with the objective of the student's curriculum. Credit may be disallowed for work previously completed due to the remoteness of the time of study. These applicants, however, will be granted the privilege of taking an examination for credit.

2. For placement: Applicants who, as a result of previous training and experience, may be considered to possess sufficient knowledge of a subject will be allowed the privilege of taking a special examination in particular courses.

The grade of B or better must be obtained in any examinations taken for placement or advanced standing credit. Students who have been dismissed from another institution for academic reasons must accompany their application with a statement from the Dean or other appropriate official of their previous institution setting forth the reasons for dismissal or probationary status with recommendation for continued study. All applications will be considered on their own merits.

In all cases students admitted by transfer or advanced standing credit from any other institution must meet the requirements for matriculated status as set forth under the regulations applicable to regular students.

Resident Requirement

Every candidate for the B.S. or Associate Degree must fulfill the residence requirement. The residence requirement is defined as the taking and satisfactory completion in University College immediately preceding graduation of 30 consecutive semester hours of work in course; with the further provision that at least 10 of the 30 semester hours must be in the candidate's major field. All programs to meet the residency requirement must have the approval of the Dean. Students whose attendance in degree programs is interrupted for a period of one year or more will be reinstated into the program in effect at the time of their re-entry into University College.

In the case of students who for causes beyond their control move outside of the reasonable commuting area of the College, and who have completed 100 or more semester hours of credit in course, the Committee on Education will entertain a petition to allow them the privilege of completing their degree requirements at some other approved College. Under no circumstances will a degree be awarded to any student who has completed less than 30 semester hours of credit in courses in University College.

Students attending certificate programs must complete in residence the full semester hour requirements of the programs in required courses or substitutions approved by the Dean.

Attendance at Commencement

All candidates for a first degree (bachelor or associate) are required to attend Commencement in the year of qualification. First degrees in absentia are awarded only to candidates excused for personal or immediate-family illness, military service, or employment obligations beyond the control of the candidate.

A petition to receive a degree in absentia must be presented to the dean of the school or college in which the candidate qualifies. Each petition will be acted upon by the academic dean involved, the candidate having the privilege of appeal to the Provost.

Degree Requirements

- I. The Degree of Bachelor of Science (B.S.) is awarded upon completion of 130 semester hours of credit in course according to the following credit distribution:

	<i>Semester Hours</i>
a. Core Courses and Sequences in Liberal Arts	74
b. Professional and Elective Courses	56
Total requirements for the degree	130

See each curriculum for specific requirements in professional area. (See pages 50-74.)

- II. The Associate Degree is awarded upon completion of a minimum of 60 semester hours of credit in course sequences approved by the faculty to students who have satisfied the requirements for degree matriculation.

Graduation with Honors

Honors are based upon the excellence of the work performed by the students in the College. Three honorary distinctions are conferred upon properly qualified candidates for the bachelor's degree upon graduation:

Highest honors to those who have completed all work with a quality point average of 3.75 or better.

High honors to those who have completed all work with a quality point average of 3.50 or better.

Honors to those who have completed all work with a quality point average of 3.25 or better.

To be entitled to honors a student must have completed a minimum of 60 semester hours of work in University College.

Courses credited by advanced standing, whether by transfer or by examination, will be eliminated in determining honors.

University College

General Information

Class Sessions

Classes are held each evening, Monday through Friday, and on Saturday morning. *The normal schedule for students pursuing a degree, title or certificate program is not more than eight semester hours per semester. Students may arrange their schedules so as to attend classes one, two or three sessions a week, depending upon the number of subjects taken.* Students interested in the schedule of classes should apply to the College Office.

Attendance

The limited amount of time devoted to each subject and the rapid rate of progress in covering the essential content of a course make it highly desirable that students be present at every session. Because of the importance of regular attendance and its bearing upon the quality of scholarship, the policies governing attendance are:

Students must attend 70% of the lecture sessions to be eligible to take the final examination.

Attendance credit is granted only when the student is in attendance at least three-quarters of the class period. Three separate absences of less than 30 minutes each constitute one complete absence.

Outside Preparation

It is expected that students will devote on the average two hours to preparation for each hour spent in the classroom. A student carrying a normal program will, therefore, be expected to devote to outside preparation an average of eleven to twelve hours a week. Some courses require more time for preparation than others.

Notify the Office Immediately

Of change of address.

Of withdrawal from any course — otherwise the fee for that course will be charged.

Of withdrawal from the College, giving date of the last session attended.

Term Tests

Two one-hour tests are regularly scheduled in each semester, usually on the sixth and eleventh sessions. These tests are regarded as part of the term or course work. A student who, for justifiable reasons, fails to take a term test may be allowed one make-up privilege upon petition for the same within one week of the date of the original test. The registrar will assign the time and place. A fee of \$3.00 is charged for each make-up test, payable at the time of filing the petition.

Final Examination

The general policies governing final examinations are:

A final examination will be held at the end of each course unless an announcement to the contrary is made.

The minimum passing grade in a regular final examination is D.

Students who, for justifiable reasons, are unable to take a final examination will receive a grade of "incomplete" and may be allowed the privilege of a make-up examination. This examination will be considered as the original examination for grading purposes.

A fee of \$5.00 is payable at time of filing petition for make-up examination.

Make-up Examinations

The following policies govern re-examinations:

Permission for taking a make-up examination is dependent upon the quality of the work which the student has done throughout the course and is a privilege which the Committee on Education may grant to students.

The make-up examinations are given on specified dates. Students will be notified of the specific dates of each examination.

A make-up examination for an incomplete grade must be taken within the next academic year, and all grades of "Incomplete" must be cleared within one academic year or the grade becomes N.C., and the course must be repeated for credit.

Marks and Credits

The following system of grading is in use:

Superior Work, A; Above Average Work, B; Average Work, C; Lowest Passing Grade, D; Failure, F; Incomplete, Inc.; N.C., Non-Credit.

Quality Points

The requirement for graduation from University College is 130 semester hours with attainment of a quality point average of 2.00. Although the credits allowed for acceptable work completed elsewhere by transfer students count towards fulfillment of quantitative graduation requirements, neither the credits nor the grades earned in such courses are included in quality point computations for graduation.

The method of figuring quality points is as follows: Each semester course of A grade is multiplied by 4, B grade by 3, C grade by 2, D grade by 1, and F grade or Incomplete by 0. The total number of quality points, divided by the total number of semester courses completed, shall be the quality point average.

Students receiving an F grade in a course must repeat the course in its entirety including term work, examinations and attendance.

The policy is followed of mailing all grade and status reports to students instead of issuing these reports at the College Office or over the telephone.

Probation and Discipline

The Committee on Education, in dealing with students whose work in the College may be unsatisfactory, or whose conduct is such as to make it inadvisable for them to continue as members of the student body, considers each case upon its individual merits. The following general principles are kept in mind in handling such cases:

Students whose scholarship in any given year is unsatisfactory may be dropped from the College or may be placed on probation.

When a student is placed on probation, the probation is formally imposed for a definite time and can only be extended by approval of the Committee on Education.

The Administrative Committee has the authority to dismiss from the College or place on probation at any time or to strike from the list of candidates for the degree any student whom it may deem unworthy either on account of unsatisfactory scholarship or for any great defect of conduct or character. The Committee may ask any student to withdraw from the College who is obviously out of sympathy with the aims and ideals of the College.

Classrooms and Libraries

The classrooms are furnished with modern equipment and are thoroughly adapted to evening school work. Improvements in classroom facilities are constantly being made to meet the needs of the student body.

In connection with the General Library of the University a special section is devoted to books on business subjects. In addition, the leading trade and business magazines are available for student use. Additions are constantly being made to the business section of the Library in recognition of the new demands for business education and research. The reading rooms of the



Library are open Monday through Friday from 8:45 A.M. to 7:30 P.M. They close at 4:00 P.M. on Saturdays and are not open Sundays and holidays.

All members of the College are entitled to the privilege of using the Boston Public Library including the Business Branch at 20 City Hall Avenue.

Textbooks and Supplies

The Northeastern University Bookstore is a department of the University and is operated for the convenience of the student body. All books and supplies which are required by the students for their work in the University may be purchased at the Bookstore located in Richards Hall. In addition, the Bookstore also carries a large number of general supplies.

Student Council

The social and extracurricular life of the College is in charge of the Student Council, consisting of representatives from each class or school group. In addition to arranging for occasional social affairs, special lectures and meetings, the Council represents the interests of the student body. The faculty and the officials advise with the Council in regard to College policies.



The Student Council sponsors two dances each year for University College students and guests.

Honor Fraternity

Sigma Epsilon Rho is the honor fraternity of University College. Its purposes are:

To promote acquaintance and good fellowship among those men who have attained highest scholastic standing in the College.

To stimulate the student body to higher scholastic accomplishment through the bearing, influence and work of these selected men.

To develop methods of mutual improvement and advancement among the members of this fraternity.

To support high moral, professional and scholastic ideals.

Only honor graduates or seniors with honor standing at the end of the junior year are eligible for admission to the fraternity. Admission is by invitation after nomination by the College faculty.

An outstanding business book is awarded each year by Sigma Epsilon Rho Fraternity to the highest ranking student at the conclusion of the junior year. Students will receive the award only in the event that they enroll for the subsequent year.

University College

Tuition, Fees and Scholarships

Tuition and fees are not transferable and are refundable only as stated under "Refund of Tuition."

Checks and drafts for all charges are to be drawn to the order of North-eastern University.

There are no auditors or auditor's rates in University College.

Application Fee

The University application fee of \$5.00 must accompany the initial application for admission to the University. This fee is non-refundable.

Matriculation Fee

A matriculation fee of \$5.00 must accompany the petition for degree candidacy filed after the completion of 30 semester hours of work in University College and under the conditions set forth for matriculation as a degree candidate. This fee is non-refundable.

Tuition

Tuition for all credit courses is charged at the rate of twenty dollars (\$20.00) per semester hour of credit. Charges for registration and tuition for special courses are at the rate and on the basis of payment specified for each course.

Tuition for degree or certificate candidates for all credit courses is charged on the semester basis payable at the beginning of each semester. As a convenience, however, the tuition each semester may be payable in two (2) installments; the second installment is payable on November 15 and March 1 in the first and second semesters respectively.

Tuition for a special student registered in a special course is charged for the entire course and is payable in a single payment at the beginning of the course unless otherwise arranged.

Tuition Budget Payment Plans

Occasionally situations develop — usually beyond the control of the student — which make it difficult to meet the payments in the manner outlined above. Under such circumstances the student is advised to discuss his problem personally with the Bursar's Office where one of the budget plans or a deferred payment agreement may be worked out. Such arrangements should be made before the end of the first week of the semester or within one week of the date of registration if the student enters late. Failure to take immediate action will result in a late payment fee.

Tuition Underwritten by Employers

An increasing number of companies are underwriting in part or whole the cost of tuition of students in their employ. In cases where payment is to be made directly by the employer to the University, the student should furnish to the Bursar's Office a purchase order covering his registration or a statement from an officer of his company certifying that the company is underwriting the tuition.

Late Payment Fee

Bills for tuition and fees are payable on or before Saturday of the week of issuance. A Late Payment Fee of \$2.00 is charged for all students failing to comply unless special payment arrangements are approved by the Bursar's Office.

Courses in Other Departments of the University

University College students assigned to courses in other departments of the University are charged the tuition rates and other fees effective in the departments to which they are assigned.

General Fees

A fee of \$3.00 is charged for each make-up test, \$5.00 for each make-up final examination or advanced standing examination. This fee must be paid at the time of filing the petition for the privilege.

The University graduation fee, charged to those who are candidates for the Bachelor or Associate degree, is \$20, payable on or before May 1st of the year in which the student expects to graduate.

Expense for Books and Materials

Students purchase their own textbooks and working materials. The cost varies according to the subjects for which the student is enrolled. The average cost for a normal program of three subjects is about \$15, with a maximum of approximately \$25. The textbooks for single courses range from \$3.00 to \$8.00.

General Financial Information

Checks should be drawn payable to Northeastern University.

Students are not permitted to attend class sessions or take any examination or tests until they have paid their tuition fees or have made satisfactory arrangements for payments.

Students will not be advanced in class standing, or permitted to re-enroll in the University, nor will degrees be conferred until all financial obligations to the University have been met.

No certificate of honorable dismissal will be issued to any student who has not fully met his financial obligations to the University.

Statement of Tuition Refund Policy

The University provides all instruction and accommodations on an academic semester basis; therefore, no refunds are granted except in cases where students are compelled to withdraw on account of personal illness or other reasons beyond their control. In no event will a refund be made if individual's attendance is recorded beyond the fifth class session. A student must complete an official withdrawal application before being considered for refund. Questions regarding refunds should be discussed with the Bursar's Office.

Scholarships, Awards and Loan Funds

The following scholarships and awards are available to students enrolled for a normal schedule of fifteen or more semester hours of classwork who are pursuing a degree program in University College.

THE CLARKSON ALUMNI AWARD

This award, made available through the Alumni Association of the University College, is in memory of George S. Clarkson, a member of the Class of 1914 and an instructor in Accounting for many years. This award, which is indeterminate in amount, is granted to the student who obtains the highest cumulative average in one of the Accounting curricula at the close of his Junior year. To be eligible, the student must have completed 30 semester hours of credit in residence in Accounting courses. If he is eligible for an award of greater monetary value, the Clarkson Alumni Award will be made to the next highest ranking student who is eligible. To be eligible for this scholarship the student must pursue a normal schedule the following year.

DEAN RUSSELL WHITNEY MEMORIAL SCHOLARSHIP

Alpha Chapter of the Pi Tau Kappa Fraternity sponsors an annual tuition scholarship in memory of former Dean Russell Whitney. The award is made available to the man in the University College whose qualities of leadership and influence among his fellow students, whose strength of character, whose record of scholarship and broad achievement mark him as outstanding. The award is made available to the student who has completed a minimum of 60 semester hours. To be eligible for this scholarship the student must pursue a normal schedule during the year in which the award is made.

RABBI MYER O. GRUNBERG SCHOLARSHIP FUND

This scholarship is available through a fund established by Mrs. Sarah Grunberg in memory of her husband, Rabbi Myer O. Grunberg.

The purpose of this scholarship is to recognize the spirit of "Good Will Towards Men" as practiced in everyday living.

The annual award will be made to that man or woman student who has evidenced in personal, business, and student relationships those characteristics of leadership and human relations which make for a better social order. The recipient must be a candidate for a degree in the University College.

KAPPA TAU PHI SCHOLARSHIP

This scholarship award of one quarter tuition is made available by the Kappa Tau Phi Sorority. It is granted annually to the woman student who ranks highest in her class at the end of the Upper-Middler year unless she is eligible for an award of greater monetary value, in which event the award will be made to the next highest ranking woman student. To be eligible for this scholarship, the student must be enrolled in a program of at least two evenings per week and pursue a like schedule in the following year. She must be a candidate for a bachelor's degree and not be eligible for assistance under the G.I. Bill of Rights. In determining this award, grades of all courses completed in prior years shall be considered.

HARRY OLINS SCHOLARSHIP

The Harry Olins Scholarship Fund was established as an expression of firm belief in the University College students and "what they stand for." The fund, presented by Mrs. Harry Olins in recognition of her husband's long service on the faculty, makes available an annual tuition award to that student who in terms of scholastic achievement, character, and personal need best typifies the spirit of Northeastern University.

To be eligible for this award the student must be a degree candidate and carry a full academic load during the school year.

TRAFFIC CLUB OF NEW ENGLAND SCHOLARSHIP

The Traffic Club of New England provides four scholarships annually for persons employed in the field of transportation and traffic management. Each scholarship covers tuition, books, and incidental expenses involved in the two courses, "Transportation Practices" and "Traffic Management." The objective of the scholarship is to introduce four new persons annually to education in the field of transportation and traffic management, after which it is assumed that they will continue for the complete program at their own expense. Two students each will be selected from carrier traffic departments and industrial traffic departments annually. The scholarship proposals are administered co-operatively by the Scholarship Committee of the Traffic Club of New England. Applications for the scholarships must be secured from and filed with the Secretary, the Traffic Club of New England, 210 Lincoln Street, Boston, Massachusetts.

ALUMNI LOAN FUND

The Alumni Association of University College has provided a loan fund which is available to students in the Senior and Junior classes who are in need of financial assistance in order to continue their studies. Applications for loans should be addressed to the Dean of the college. All applications must be approved by the Alumni Loan Fund Committee.

UNIVERSITY COLLEGE LOAN FUND

By vote of the Student Council, a part of the Student Activities fees for 1937-1938 was set aside to provide a loan fund which is available to students temporarily in need of small loans for tuition or other College charges. Students needing assistance from this fund should confer with the Dean.

University College

Programs of Instruction

Programs of Instruction

UNIVERSITY COLLEGE conducts educational programs on the undergraduate level. The programs are designed to meet the varying needs of students attending evening college and are represented in four main groups:

- 1. The Bachelor of Science Degree (B.S.) requires 130 semester hours of credit in course.
- 2. The Associate Degree in Management or Accounting requires 60 semester hours of credit in course.
- 3. Certificate programs offered through the several Institutes which require a minimum of 30 semester hours of credit in course.
- 4. Single courses or special programs for the special student.

Degree Requirements

I. University College programs leading to the Bachelor of Science Degree provide opportunities for cultural and professional development equivalent in quality and scope to those offered in the conventional four-year college enrolling full-time students.

	Semester Hours
a. Core Courses — and Sequences in the Liberal Arts.....	74
b. Professional and Elective Courses.....	56
Total requirements for the degree.....	130

See each curriculum for specific requirements.

Curricula are offered in the following fields:

Accounting

Public Accounting	See page 50
Commercial or Industrial Accounting	See page 51
Cost Accounting	See page 52

Management

Business Management	See page 53
Credit and Financial Management	See page 54
Industrial Management	See page 55
Insurance	See page 56
Marketing — Sales and Advertising	See page 57
Office Management	See page 58
Personnel and Industrial Relations	See page 59
Production Management	See page 60
Production Management — Material Handling	See page 61
Real Estate	See page 62
Retailing	See page 63
Transportation and Traffic Management	See page 64

Technology

Degree Curricula in Technology

Construction Technology	See page 66
Industrial Technology	See page 67
Manufacturing Technology	See page 68
Surveying Technology	See page 69

Degree Curricula in Liberal Arts and Management

Administration	See page 72
Personnel and Industrial Relations	See page 73
Sales	See page 74

II. The Associate Degree is awarded upon completion of a minimum of 60 semester hours of credit in course sequences approved by the faculty.

III. Programs for Administrative Secretaries See page 88

IV. Special Programs See page 92

Certificate Programs

The several Institute programs listed below are designed to serve those who have specific needs in relatively well-defined areas. They are professionally oriented and include courses applied to operations within the specific fields. The certificate requirements are indicated for each Institute program.

Certificate programs with specifications in:

Institute of Credit and Financial Management	See page 76
Institute for Business and Professional Secretaries	See pages 88-90
Institute of Distribution	See page 77
Institute of Industrial and Commercial Material Handling	See page 78
Institute of Insurance	See page 79
Institute of Retailing	See page 80
Institute of Transportation and Traffic Management	See page 81
Labor Relations Institute	See page 82
Office Management Institute	See page 83
Production Management Institute	See page 84
Quality Control Institute	See page 85
Real Estate Institute	See page 86

Special Programs

University College through the Department of Special Programs of the Office of Adult and Continuing Education will make available a wide variety of specially designed courses. These on-campus, non-credit courses are offered to serve specific needs of the individual and frequently are co-sponsored by professional societies, trade associations and civic agencies. Other short courses, seminars, conferences and forums provide specialized instruction attuned to current trends and developments. The tuition, registration fee, length of course or program, and subject matter are dependent upon the course objectives and design.

Over 2,000 persons were registered last year in such programs as State and Federal Tax Forums, Labor-Management Forum, Workshops in the Management of Small Business, Residential Seminar for Professional Secretaries, Courses for X-Ray Technicians, Environmental Tests and Testing, Rubber Technology, Glass Technology, Accident Investigation, Course for Motor Fleet Maintenance Supervisors, Purchasing, Applied Security Analysis, etc.

Northeastern University through the Office of Adult and Continuing Education is ideally qualified to develop all kinds of special programs on the collegiate level to assist in the educational needs of special groups in a period of rapid economic, technological and social change.

Bureau of Business and Industrial Training

Another vital service Northeastern renders to local business and industry is the in-plant program provided by the Bureau of Business and Industrial Training under the Office of Adult and Continuing Education.

These courses, training programs, sales and management seminars in general evolve out of specific company needs, both present and future, and are custom-built to meet those needs.

Business firms or individuals concerned with special training needs are invited to direct inquiry for further information to the Director of the Bureau.

University College

Programs in Management

PUBLIC ACCOUNTING (C.P.A.)

Leading to the Degree of Bachelor of Science

semester hours

CORE COURSES — required.....		50
Accounting:		
A1-2	Introductory Accounting.....	4
Distribution:		
D1-2	Principles of Distribution.....	4
Economics:		
Ec1-2	Business Economics.....	4
Ec3-4	Financing Business Operations.....	4
Ec5-6	Financial Policies and Planning.....	4
English:		
E1-2	English and Business Communications.....	4
E3-4	Business Writing and Reports.....	4
Industrial Management:		
IM8-9	Production Planning and Control.....	4
Industrial Relations:		
IR20	Labor-Management Relations.....	2
Law:		
L1-2	Legal Aspects of Business I.....	4
L3-4	Legal Aspects of Business II.....	4
Mathematics:		
M2-3	Mathematics.....	4
Statistics:		
Ec20	Management Statistics.....	2
Ec21	Management Statistics — Business Applications.....	2
LIBERAL ARTS — required.....		24
LA1-2	Man and the Physical Universe	
LA3-4	Man in Society	
LA5-6	Man's Cultural Inheritance	
LA7-8	Man and Values	
PROFESSIONAL COURSES — required.....		46½
A3-4	Intermediate Accounting.....	4
A5-6	Accounting Problems.....	5
A7-8	Advanced Accounting Problems.....	5
A9-10	C.P.A. Problems.....	10
A11	Fund Accounting.....	2½
A12	Constructive Accounting.....	2½
A13	Mathematics of Accounting.....	2½
A14-15	Cost Accounting.....	5
A18-19	Auditing.....	5
A50-51	Basic Federal Taxes.....	5
PROFESSIONAL COURSES — elective.....		9½
Selected from the following:		130
A34	Anal. of Financial Statements	
A35-36	Controllershship	
A37	Punch Card Accounting	
A52-53	Advanced Federal Taxes	
D50	Credit Fundamentals	
D51	Credit Problems	
Ec7	Investment Principles	
Ec23	Statistical Meth. in Forecasting	
Ec30	International Economics	
Ec31	Managerial Economics	
Ec34-35	Bus. Plng. and Research	
In3	Insurance for Management	
IR8	Tech. of Supervision	
OM1	Office Mgmt. Practices	
OM2	Scientific Mgmt. in Off. Prac.	
OM3	Bus. Org. and Administration	
OM10	Office Systems & Procedures	
OM11	Forms Design and Control	
OM15	Elec. Data Processing Systems	
OM16	Elec. Data Programming	

Courses other than those listed above may be used for elective course credit upon approval of the Dean. Students should make certain that all prerequisite requirements have been satisfied before registering for courses.

COMMERCIAL OR INDUSTRIAL ACCOUNTING

Leading to the Degree of Bachelor of Science

semester hours

CORE COURSES — required..... 50

Accounting:

A1-2 Introductory Accounting..... 4

Distribution:

D1-2 Principles of Distribution..... 4

Economics:

Ec1-2 Business Economics..... 4

Ec3-4 Financing Business Operations..... 4

Ec5-6 Financial Policies and Planning..... 4

English:

E1-2 English and Business Communications..... 4

E3-4 Business Writing and Reports..... 4

Industrial Management:

IM-9 Production Planning and Control..... 4

Industrial Relations:

IR20 Labor-Management Relations..... 2

Law:

L1-2 Legal Aspects of Business I..... 4

L3-4 Legal Aspects of Business II..... 4

Mathematics:

M2-3 Mathematics..... 4

Statistics:

Ec20 Management Statistics..... 2

Ec21 Management Statistics — Business Applications..... 2

LIBERAL ARTS — required..... 24

LA1-2 Man and the Physical Universe

LA5-6 Man's Cultural Inheritance

LA3-4 Man in Society

LA7-8 Man and Values

PROFESSIONAL COURSES — required..... 41 $\frac{1}{2}$

A3-4 Intermediate Accounting..... 4

A5-6 Accounting Problems..... 5

A7-8 Advanced Accounting Problems..... 5

A12 Constructive Accounting..... 2 $\frac{1}{2}$ A13 Mathematics of Accounting..... 2 $\frac{1}{2}$

A14-15 Cost Accounting..... 5

A20-21 Internal Auditing..... 5

A34 Analysis of Financial Statements..... 2 $\frac{1}{2}$

A35-36 Controllorship..... 5

A50-51 Basic Federal Taxes..... 5

PROFESSIONAL COURSES — elective..... 14 $\frac{1}{2}$ 130

Selected from the following:

A37 Punch Card Accounting

A52-53 Advanced Federal Taxes

D50 Credit Fundamentals

D51 Credit Problems

Ec7 Investment Principles

Ec23 Statistical Meth. in Forecasting

Ec30 International Economics

Ec31 Managerial Economics

Ec34-35 Business Plng. and Research

E12 Business Conferences

In3

Insurance for Management

IR1

Psychology for Business

IR8

Techniques of Supervision

OM1

Office Management Practices

OM2

Scientific Mgmt. in Office Prac.

OM3

Bus. Organization and Adm.

OM10

Office Systems & Procedures

OM11

Forms Design and Control

OM15

Elec. Data Processing Systems

OM16

Elec. Data Programming

Courses other than those listed above may be used for elective course credit upon approval of the Dean. Students should make certain that all prerequisite requirements have been satisfied before registering for courses.

COST ACCOUNTING

Leading to the Degree of Bachelor of Science

semester hours

CORE COURSES — required..... 50

Accounting:		
A1-2	Introductory Accounting.....	4
Distribution:		
D1-2	Principles of Distribution.....	4
Economics:		
Ec1-2	Business Economics.....	4
Ec3-4	Financing Business Operations.....	4
Ec5-6	Financial Policies and Planning.....	4
English:		
E1-2	English and Business Communications.....	4
E3-4	Business Writing and Reports.....	4
Industrial Management:		
IM8-9	Production Planning and Control.....	4
Industrial Relations:		
IR20	Labor-Management Relations.....	2
Law:		
L1-2	Legal Aspects of Business I.....	4
L3-4	Legal Aspects of Business II.....	4
Mathematics:		
M2-3	Mathematics.....	4
Statistics:		
Ec20	Management Statistics.....	2
Ec21	Management Statistics — Business Applications.....	2

LIBERAL ARTS — required..... 24

LA1-2	Man and the Physical Universe	LA5-6	Man's Cultural Inheritance
LA3-4	Man in Society	LA7-8	Man and Values

PROFESSIONAL COURSES — required..... 46½

A3-4	Intermediate Accounting.....	4
A5-6	Accounting Problems.....	5
A7-8	Advanced Accounting Problems.....	5
A12	Constructive Accounting.....	2½
A13	Mathematics of Accounting.....	2½
A14-15	Cost Accounting.....	5
A16-17	Advanced Cost Accounting.....	5
A20-21	Internal Auditing.....	5
A34	Analysis of Financial Statements.....	2½
A35-36	Controllorship.....	5
A50-51	Basic Federal Taxes.....	5

PROFESSIONAL COURSES — elective..... 9½
130

Selected from the following:

A37	Punch Card Accounting	IM15	Manufacturing Mgmt. Seminar
A52-53	Advanced Federal Taxes	IR8	Tech. of Supervision
D50	Credit Fundamentals	OM1	Office Mgmt. Practices
Ec7	Investment Principles	OM2	Scientific Mgmt. in Office Prac.
Ec23	Statistical Meth. in Forecasting	OM3	Bus. Organization and Adm.
Ec30	International Economics	OM10	Office Systems & Procedures
Ec31	Managerial Economics	OM11	Forms Design and Control
Ec34-35	Business Plng. and Research	OM15	Elec. Data Proc. Systems
In3	Insurance for Management	OM16	Elec. Data Programming

Courses other than those listed above may be used for elective course credit upon approval of the Dean. Students should make certain that all prerequisite requirements have been satisfied before registering for courses.

BUSINESS MANAGEMENT

Leading to the Degree of Bachelor of Science

semester hours

CORE COURSES — required..... 50

Accounting:		
A30-31	Managerial Accounting.....	4
Distribution:		
D1-2	Principles of Distribution.....	4
Economics:		
Ec1-2	Business Economics.....	4
Ec3-4	Financing Business Operations.....	4
Ec5-6	Financial Policies and Planning.....	4
English:		
E1-2	English and Business Communications.....	4
E3-4	Business Writing and Reports.....	4
Industrial Management:		
IM8-9	Production Planning and Control.....	4
Industrial Relations:		
IR20	Labor-Management Relations.....	2
Law:		
L1-2	Legal Aspects of Business I.....	4
L3-4	Legal Aspects of Business II.....	4
Mathematics:		
M2-3	Mathematics.....	4
Statistics:		
Ec20	Management Statistics.....	2
Ec21	Management Statistics — Business Applications.....	2

LIBERAL ARTS — required..... 24

LA1-2	Man and the Physical Universe	LA5-6	Man's Cultural Inheritance
LA3-4	Man in Society	LA7-8	Man and Values

PROFESSIONAL COURSES — required..... 29½

A32	Financial and Administrative Accounting.....	2½
A33	Managerial Cost Controls.....	2½
D50	Credit Fundamentals.....	2½
Ec12	Government Controls.....	2½
Ec23	Statistical Methods in Forecasting.....	2
Ec34-35	Business Planning and Research.....	5
OM1	Office Management Practices.....	2½
Ec31	Managerial Economics.....	2½
In3	Insurance for Management.....	2½
IR2-3	Human Relations.....	5

PROFESSIONAL COURSES — elective..... 26½130**Selected from the following:**

D5	Principles of Salesmanship	E10	Effective Speaking for Business
D6	Techniques of Salesmanship	E12	Business Conferences
D9	Sales Executive Training	IM14	Materials Mgmt. Seminar
D10	Market Research	IM15	Manufacturing Mgmt. Seminar
D11	Mkt. Mgmt. Seminar	IR1	Psychology for Business
D20-21	Principles of Advertising	IR4	Personnel Mgmt. Practices
D22	Advertising Problems	IR7	Practical Training Methods
D30-31	Foreign Trade	M4-5	Graphic & Math. Tech. in Ind.
D40	Purchasing	OM2	Scientific Mgmt. in Office Practice
D51	Credit Problems	OM3	Bus. Organization & Adm.
Ec7	Investment Principles	OM15	Elec. Data Proc. Systems
Ec11	Economic Geography	OM16	Elec. Data Programming
Ec30	International Economics	RE1	Real Estate Fundamentals

Courses other than those listed above may be used for elective course credit upon approval of the Dean. Students should make certain that all prerequisite requirements have been satisfied before registering for courses.

CREDIT AND FINANCIAL MANAGEMENT

Leading to the Degree of Bachelor of Science

semester hours

CORE COURSES — required..... 50

Accounting:		
A30-31	Managerial Accounting.....	4
Distribution:		
D1-2	Principles of Distribution.....	4
Economics:		
Ec1-2	Business Economics.....	4
Ec3-4	Financing Business Operations.....	4
Ec5-6	Financial Policies and Planning.....	4
English:		
E1-2	English and Business Communications.....	4
E3-4	Business Writing and Reports.....	4
Industrial Management:		
IM8-9	Production Planning and Control.....	4
Industrial Relations:		
IR20	Labor-Management Relations.....	2
Law:		
L1-2	Legal Aspects of Business I.....	4
L3-4	Legal Aspects of Business II.....	4
Mathematics:		
M2-3	Mathematics.....	4
Statistics:		
Ec20	Management Statistics.....	2
Ec21	Management Statistics — Business Applications.....	2

LIBERAL ARTS — required..... 24

LA1-2	Man and the Physical Universe	LA5-6	Man's Cultural Inheritance
LA3-4	Man in Society	LA7-8	Man and Values

PROFESSIONAL COURSES — required..... 29½

A32	Financial and Administrative Accounting.....	2½
D50	Credit Fundamentals.....	2½
D51	Credit Problems.....	2½
Ec7	Investment Principles.....	2½
Ec8-9	Applied Security Analysis.....	5
Ec23	Statistical Methods in Forecasting.....	2
Ec30	International Economics.....	2½
Ec32	Monetary Policy.....	2½
Ec34-35	Business Planning and Research.....	5
In3	Insurance for Management.....	2½

PROFESSIONAL COURSES — elective..... 26½

130

Selected from the following:

A50-51	Basic Federal Taxes	Ec31	Managerial Economics
D5	Principles of Salesmanship	E10	Effective Speaking for Business
D10	Market Research	E12	Business Conferences
D20-21	Principles of Advertising	In10-11	Fidelity, Suretyship & Crime Ins.
D22	Advertising Problems	OM1	Office Mgmt. Practices
D30-31	Foreign Trade	OM2	Scientific Mgmt. in Office Prac.
D40	Purchasing	OM3	Business Org. & Administration
D52	Consumer Credit	OM11	Forms Design and Control
Ec11	Economic Geography	OM15	Elec. Data Processing Systems
Ec12	Government Controls in Bus.	OM16	Elec. Data Programming

Courses other than those listed above may be used for elective course credit upon approval of the Dean. Students should make certain that all prerequisite requirements have been satisfied before registering for courses.

INDUSTRIAL MANAGEMENT

Leading to the Degree of Bachelor of Science

semester hours

CORE COURSES — required..... 50

Accounting:

A30-31 Managerial Accounting..... 4

Distribution:

D1-2 Principles of Distribution..... 4

Economics:

Ec1-2 Business Economics..... 4

Ec3-4 Financing Business Operations..... 4

Ec5-6 Financial Policies and Planning..... 4

English:

E1-2 English and Business Communications..... 4

E3-4 Business Writing and Reports..... 4

Industrial Management:

IM8-9 Production Planning and Control..... 4

Industrial Relations:

IR20 Labor-Management Relations..... 2

Law:

L1-2 Legal Aspects of Business I..... 4

L3-4 Legal Aspects of Business II..... 4

Mathematics:

M2-3 Mathematics..... 4

Statistics:

Ec20 Management Statistics..... 2

IM20 Management Statistics — Quality Control..... 2

LIBERAL ARTS — required..... 24

LA1-2 Man and the Physical Universe

LA5-6 Man's Cultural Inheritance

LA3-4 Man in Society

LA7-8 Man and Values

PROFESSIONAL COURSES — required..... 29

A32 Financial and Administrative Accounting..... 2½

A33 Managerial Cost Controls..... 2½

IM2 Work Measurements I..... 2½

IM5 Work Simplification I..... 2½

IM30-31 Plant Layout..... 5

IM40-41 Material Handling Fundamentals..... 5

IR2-3 Human Relations..... 5

M4-5 Graphic & Mathematical Tech. in Industry... 4

PROFESSIONAL COURSES — elective..... 27

130

Selected from the following:

D40 Purchasing
 Ec31 Managerial Economics
 IM3 Work Measurements II
 IM4 Syn. Time Stds. M.T.M.
 IM6 Work Simplification II
 IM7 Job Analysis & Evaluation
 IM10 Materials of Production
 IM11 Production Processes
 IM13 Industrial Safety
 IM14 Materials Mgmt. Seminar
 IM15 Manufacturing Mgmt. Seminar

IM21-23 Quality Control Courses
 IM42-51 Material Handling Courses
 In3 Insurance for Management
 IR2-3 Human Relations
 IR5 Wage Administration
 IR7 Practical Training Methods
 IR21 Lab. Leg. — Union-Mgmt. Relations
 IR22 Lab. Leg. — Stds. & Conditions
 IR23 Labor Agreement
 OM3 Bus. Organization & Adm.
 T1 Transportation Practices

Courses other than those listed above may be used for elective course credit upon approval of the Dean. Students should make certain that all prerequisite requirements have been satisfied before registering for courses.

INSURANCE

Leading to the Degree of Bachelor of Science

		semester hours
CORE COURSES — required.....		50
Accounting:		
A30-31	Managerial Accounting.....	4
Distribution:		
D1-2	Principles of Distribution.....	4
Economics:		
Ec1-2	Business Economics.....	4
Ec3-4	Financing Business Operations.....	4
Ec5-6	Financial Policies and Planning.....	4
English:		
E1-2	English and Business Communications.....	4
E3-4	Business Writing and Reports.....	4
Industrial Management:		
IM8-9	Production Planning and Control.....	4
Industrial Relations:		
IR20	Labor-Management Relations.....	2
Law:		
L1-2	Legal Aspects of Business I.....	4
L3-4	Legal Aspects of Business II.....	4
Mathematics:		
M2-3	Mathematics.....	4
Statistics:		
Ec20	Management Statistics.....	2
Ec21	Management Statistics — Business Applications.....	2
LIBERAL ARTS — required.....		24
LA1-2	Man and the Physical Universe	LA5-6 Man's Cultural Inheritance
LA3-4	Man in Society	LA7-8 Man and Values
PROFESSIONAL COURSES — required.....		30
In2-3	Principles of Insurance.....	5
In4-5	Casualty Insurance.....	5
In6-7	Fire and Allied Lines.....	5
In8-9	Inland Marine.....	5
In10-11	Fidelity, Suretyship Crime.....	5
In13-14	Claims Procedure.....	5
PROFESSIONAL COURSES — elective.....		26
Selected from the following:		130
A32	Financial & Adm. Accounting	IR2-3 Human Relations
D5	Principles of Salesmanship	IR8 Techniques of Supervision
D6	Techniques of Salesmanship	OM1 Office Mgmt. Practices
D9	Sales Executive Training	OM2 Scientific Mgmt. in Office Prac.
D20-21	Principles of Advertising	OM3 Business Organization & Adm.
Ec7	Investment Principles	RE1 Real Estate Fundamentals
Ec34-35	Business Plng. & Research	RE2 Real Estate Law & Conveyancing
E10	Effective Speaking for Business	RE3 Real Estate Mgmt. & Investment
E12	Business Conferences	RE4 Real Estate Finance
IR1	Psychology for Business	Ec23 Statistical Methods in Forecasting

Courses other than those listed above may be used for elective course credit upon approval of the Dean. Students should make certain that all prerequisite requirements have been satisfied before registering for courses.

MARKETING — SALES AND ADVERTISING

Leading to the Degree of Bachelor of Science

semester hours

CORE COURSES — required.....	50
Accounting:	
A30-31 Managerial Accounting.....	4
Distribution:	
D1-2 Principles of Distribution.....	4
Economics:	
Ec1-2 Business Economics.....	4
Ec3-4 Financing Business Operations.....	4
Ec5-6 Financial Policies and Planning.....	4
English:	
E1-2 English and Business Communications.....	4
E3-4 Business Writing and Reports.....	4
Industrial Management:	
IM8-9 Production Planning and Control.....	4
Industrial Relations:	
IR20 Labor-Management Relations.....	2
Law:	
L1-2 Legal Aspects of Business I.....	4
L3-4 Legal Aspects of Business II.....	4
Mathematics:	
M2-3 Mathematics.....	4
Statistics:	
Ec20 Management Statistics.....	2
Ec21 Management Statistics — Business Applications.....	2
LIBERAL ARTS — required.....	24
LA1-2 Man and the Physical Universe	LA5-6 Man's Cultural Inheritance
LA3-4 Man in Society	LA7-8 Man and Values
PROFESSIONAL COURSES — required.....	29 ¹ ₂
A32 Financial and Administrative Accounting.....	2 ¹ ₂
D5 Principles of Salesmanship.....	2 ¹ ₂
D20-21 Principles of Advertising.....	5
D30-31 Foreign Trade.....	5
D50 Credit Fundamentals.....	2 ¹ ₂
Ec11 Economic Geography.....	2 ¹ ₂
Ec31 Managerial Economics.....	2 ¹ ₂
D7 Sales Promotion.....	2 ¹ ₂
Ec23 Statistical Methods in Forecasting.....	2
D10 Market Research.....	2 ¹ ₂
PROFESSIONAL COURSES — elective.....	26 ¹ ₂
	130

Selected from the following:

D6 Techniques of Salesmanship	Ec12 Government Controls in Business
D8 Sales Management	Ec30 International Economics
D9 Sales Executive Training	Ec34-35 Business Plng. and Research
D10 Market Research	E10 Effective Speaking for Business
D11 Marketing Mgmt. Seminar	E12 Business Conferences
D22 Advertising Problems	In3 Insurance for Management
D23 Advertising Copy	IR1 Psychology for Business
D24 Advertising Production	OM3 Bus. Organization and Adm.
D25 Advertising Media	OM15 Elec. Data Processing Systems
D40 Purchasing	OM16 Elec. Data Programming
D41 Consumer Packaging	R1 Retail Store Management
D42 Industrial Packaging	R2 Retail Store Merchandising
D51 Credit Problems	R3 Retail Store Advertising
D52 Consumer Credit	T1 Transportation Practices
Ec7 Investment Principles	T2 Traffic Management

Courses other than those listed above may be used for elective course credit upon approval of the Dean. Students should make certain that all prerequisite requirements have been satisfied before registering for courses.

OFFICE MANAGEMENT

Leading to the Degree of Bachelor of Science

	semester hours
CORE COURSES — required	50
Accounting:	
A30-31 Managerial Accounting.....	4
Distribution:	
D1-2 Principles of Distribution.....	4
Economics:	
Ec1-2 Business Economics.....	4
Ec3-4 Financing Business Operations.....	4
Ec5-6 Financial Policies and Planning.....	4
English:	
E1-2 English and Business Communications.....	4
E3-4 Business Writing and Reports.....	4
Industrial Management:	
IM8-9 Production Planning and Control.....	4
Industrial Relations:	
IR20 Labor-Management Relations.....	2
Law:	
L1-2 Legal Aspects of Business I.....	4
L3-4 Legal Aspects of Business II.....	4
Mathematics:	
M2-3 Mathematics.....	4
Statistics:	
Ec20 Management Statistics.....	2
Ec21 Management Statistics — Business Applications.....	2

LIBERAL ARTS — required	24
LA1-2 Man and the Physical Universe	LA5-6 Man's Cultural Inheritance
LA3-4 Man in Society	LA7-8 Man and Values

PROFESSIONAL COURSES — required	30
A32 Financial and Administrative Accounting.....	2½
A33 Managerial Cost Controls.....	2½
D40 Purchasing.....	2½
D50 Credit Fundamentals.....	2½
In3 Insurance for Management.....	2½
OM1 Office Management Practices.....	2½
OM2 Scientific Mgmt. in Office Practice.....	2½
OM3 Business Organization & Administration.....	2½
OM10 Office Systems and Procedures.....	2½
OM11 Forms Design and Control.....	2½
OM15 Elec. Data Processing Systems.....	2½
OM16 Elec. Data Programming.....	2½

PROFESSIONAL COURSES — elective	26
	130

Selected from the following:

D5 Principles of Salesmanship	E12 Business Conferences
D20-21 Principles of Advertising	IM7 Job Analysis & Evaluation
D51 Credit Problems	IN4-5 Casualty Insurance
D52 Consumer Credit	IN10-11 Fidelity, Suretyship & Crime Ins.
Ec7 Investment Principles	IR1 Psychology for Business
Ec12 Government Controls in Bus.	IR2-3 Human Relations
Ec23 Statistical Meth. in Forecasting	IR4 Personnel Mgmt. Practices
Ec31 Managerial Economics	IR6 Employment Testing
Ec34-35 Business Plng. and Research	OM12 Sys. Analysis & Improvement
E10 Effective Speaking for Business	T1 Transportation Practices

Courses other than those listed above may be used for elective course credit upon approval of the Dean. Students should make certain that all prerequisite requirements have been satisfied before registering for courses.

PERSONNEL AND INDUSTRIAL RELATIONS

Leading to the Degree of Bachelor of Science

		semester hours
CORE COURSES — required.....		50
Accounting:		
A30-31	Managerial Accounting.....	4
Distribution:		
D1-2	Principles of Distribution.....	4
Economics:		
Ec1-2	Business Economics.....	4
Ec3-4	Financing Business Operations.....	4
Ec5-6	Financial Policies and Planning.....	4
English:		
E1-2	English and Business Communications.....	4
E3-4	Business Writing and Reports.....	4
Industrial Management:		
IM8-9	Production Planning and Control.....	4
Industrial Relations:		
IR20	Labor-Management Relations.....	2
Law:		
L1-2	Legal Aspects of Business I.....	4
L3-4	Legal Aspects of Business II.....	4
Mathematics:		
M2-3	Mathematics.....	4
Statistics:		
Ec20	Management Statistics.....	2
Ec21	Management Statistics — Business Applications.....	2
LIBERAL ARTS — required.....		24
LA1-2	Man and the Physical Universe	LA5-6 Man's Cultural Inheritance LA7-8 Man and Values
LA3-4	Man in Society	
PROFESSIONAL COURSES — required.....		30
A32	Financial and Administrative Accounting.....	2½
IM2	Work Measurements I.....	2
IM7	Job Analysis and Evaluation.....	2
IR2-3	Human Relations.....	5
IR4	Personnel Management Practices.....	2½
IR5	Wage Administration.....	2½
IR6	Employment Testing.....	2½
IR7	Practical Training Methods.....	2
IR21	Labor Legislation — Union-Mgmt. Relations.....	2½
IR22	Labor Legislation — Standards and Conditions.....	2½
IR23	Labor Agreement.....	2
PROFESSIONAL COURSES — elective.....		26
Selected from the following:		130

A33	Managerial Cost Controls
D5	Principles of Salesmanship
Ec7	Investment Principles
Ec12	Government Controls in Bus.
Ec23	Statistical Meth. in Forecasting
Ec31	Managerial Economics
Ec34-35	Business Plng. & Research
E10	Effective Speaking for Business
E12	Business Conferences

In3	Insurance for Management
IM5	Work Simplification I
IM6	Work Measurements
IM13	Industrial Safety
IR1	Psychology for Business
IR8	Techniques of Supervision
OM1	Office Management Practices
OM2	Scientific Mgmt. in Office Practice
OM3	Business Org. & Administration

Courses other than those listed above may be used for elective course credit upon approval of the Dean. Students should make certain that all prerequisite requirements have been satisfied before registering for courses.

PRODUCTION MANAGEMENT

Leading to the Degree of Bachelor of Science

	semester hours
CORE COURSES — required.....	50
Accounting:	
A30-31 Managerial Accounting.....	4
Distribution:	
D1-2 Principles of Distribution.....	4
Economics:	
Ec1-2 Business Economics.....	4
Ec3-4 Financing Business Operations.....	4
Ec5-6 Financial Policies and Planning.....	4
English:	
E1-2 English and Business Communications.....	4
E3-4 Business Writing and Reports.....	4
Industrial Management:	
IM8-9 Production Planning and Control.....	4
Industrial Relations:	
IR20 Labor-Management Relations.....	2
Law:	
L1-2 Legal Aspects of Business I.....	4
L3-4 Legal Aspects of Business II.....	4
Mathematics:	
M2-3 Mathematics.....	4
Statistics:	
Ec20 Management Statistics.....	2
IM20 Management Statistics — Quality Control.....	2
LIBERAL ARTS — required.....	24
LA1-2 Man and the Physical Universe	12
LA3-4 Man in Society	12
LA5-6 Man's Cultural Inheritance	12
LA7-8 Man and Values	12
PROFESSIONAL COURSES — required.....	31½
A32 Financial and Administrative Accounting.....	2½
A33 Managerial Cost Controls.....	2½
IM2 Work Measurements I.....	2½
IM5 Work Simplification I.....	2½
IM11 Production Processes.....	2½
IM14 Materials Management Seminar.....	2½
IM15 Manufacturing Mgmt. Seminar.....	2½
IM30-31 Plant Layout.....	5
IM40-41 Material Handling Fundamentals.....	5
M4-5 Graphic & Mathematical Tech. in Industry.....	4
PROFESSIONAL COURSES — elective.....	24½
130	
Selected from the following:	
D40 Purchasing	IR2-3 Human Relations
Ec31 Managerial Economics	IR4 Personnel Mgmt. Practices
IM3 Work Measurements II	IR5 Wage Administration
IM4 Syn. Time Stds. M.T.M.	IR6 Employment Testing
IM6 Work Simplification II	IR8 Techniques of Supervision
IM10 Materials of Production	IR21 Lab. Leg. — Union-Mgmt. Relations
IM13 Industrial Safety	IR22 Lab. Leg. — Stds. & Conditions
IM21-23 Quality Control Courses	IR23 Labor Agreement
IM42-51 Material Handling Courses	OM3 Bus. Organization & Adm.
In3 Insurance for Management	OM15 Elec. Data Processing Systems
IR1 Psychology for Business	OM16 Elec. Data Programming

Courses other than those listed above may be used for elective course credit upon approval of the Dean. Students should make certain that all prerequisite requirements have been satisfied before registering for courses.

PRODUCTION MANAGEMENT — INDUSTRIAL AND COMMERCIAL MATERIAL HANDLING

Leading to the Degree of Bachelor of Science

semester hours

CORE COURSES — required..... 50

Accounting:		
A30-31	Managerial Accounting.....	4
Distribution:		
D1-2	Principles of Distribution.....	4
Economics:		
Ec1-2	Business Economics.....	4
Ec3-4	Financing Business Operations.....	4
Ec5-6	Financial Policies and Planning.....	4
English:		
E1-2	English and Business Communications.....	4
E3-4	Business Writing and Reports.....	4
Industrial Management:		
IM8-9	Production Planning and Control.....	4
Industrial Relations:		
IR20	Labor-Management Relations.....	2
Law:		
L1-2	Legal Aspects of Business I.....	4
L3-4	Legal Aspects of Business II.....	4
Mathematics:		
M2-3	Mathematics.....	4
Statistics:		
Ec20	Management Statistics.....	2
IM20	Management Statistics — Quality Control.....	2

LIBERAL ARTS — required..... 24

LA1-2	Man and the Physical Universe	LA5-6	Man's Cultural Inheritance
LA3-4	Man in Society	LA7-8	Man and Values

PROFESSIONAL COURSES — required..... 33

	*Applied Mechanics I, II.....	6
	*D.C. and A.C. Theory.....	6
	*Engineering Drawing I, II.....	6
	*Physics I, II.....	6
IM40-41	Material Handling Fundamentals.....	5
M4-5	Graphic and Mathematical Tech. in Industry..	4

PROFESSIONAL COURSES — elective..... 23 130

Selected from the following:

A32	Financial and Adminis. Acct.	IM42-51	Material Handling Courses
A33	Managerial Cost Controls	In3	Insurance for Management
D40	Purchasing	In4-5	Casualty Insurance
D41	Consumer Packaging	IR2-3	Human Relations
D42	Industrial Packaging & Packing	IR7	Practical Training Methods
IM11	Production Processes	IR8	Techniques of Supervision
IM13	Industrial Safety	OM15	Elec. Data Processing
IM14	Materials Mgmt. Seminar	OM16	Elec. Data Programming
IM15	Manufacturing Mgmt. Seminar	T1	Transportation Practices
IM30-31	Plant Layout	T16	Commercial Warehousing

*These courses are taken at Lincoln Institute.

Courses other than those listed above may be used for elective course credit upon approval of the Dean. Students should make certain that all prerequisite requirements have been satisfied before registering for courses.

REAL ESTATE

Leading to the Degree of Bachelor of Science

	semester hours
CORE COURSES — required	50
Accounting:	
A30-31 Managerial Accounting.....	4
Distribution:	
D1-2 Principles of Distribution.....	4
Economics:	
Ec1-2 Business Economics.....	4
Ec3-4 Financing Business Operations.....	4
Ec5-6 Financial Policies and Planning.....	4
English:	
E1-2 English and Business Communications.....	4
E3-4 Business Writing and Reports.....	4
Industrial Management:	
IM8-9 Production Planning and Control.....	4
Industrial Relations:	
IR20 Labor-Management Relations.....	2
Law:	
L1-2 Legal Aspects of Business I.....	4
L3-4 Legal Aspects of Business II.....	4
Mathematics:	
M2-3 Mathematics.....	4
Statistics:	
Ec20 Management Statistics.....	2
Ec21 Management Statistics — Business Applications.....	2
LIBERAL ARTS — required	24
LA1-2 Man and the Physical Universe	LA5-6 Man's Cultural Inheritance
LA3-4 Man in Society	LA7-8 Man and Values
PROFESSIONAL COURSES — required	30
A32 Financial and Administrative Accounting.....	2½
D5 Principles of Salesmanship.....	2½
In3 Insurance for Management.....	2½
RE1 Real Estate Fundamentals.....	2½
RE2 Real Estate Law and Conveyancing.....	2½
RE3 Real Estate Mgmt. and Investment.....	2½
RE4 Real Estate Finance.....	2½
RE5 Real Estate Sales and Advertising.....	2½
RE6 Operating a Real Estate Business.....	2½
RE7 Real Estate Appraisal — Residential.....	2½
RE8 Real Estate Appraisal — Commercial.....	2½
Ec7 Investment Principles.....	2½
PROFESSIONAL COURSES — elective	26
	130

Selected from the following:

Ec12 Govt. Controls in Business	E10 Effective Speaking for Business
Ec23 Statistical Meth. in Forecasting	E12 Business Conferences
Ec31 Managerial Economics	In4-5 Casualty Insurance
Ec34-35 Bus. Plng. and Research	In6-7 Fire and Allied Lines
D10 Market Research	In10-11 Fidelity, Suretyship & Crime Ins.
D20-21 Principles of Advertising	IR1 Psychology for Business
D50 Credit Fundamentals	IR2-3 Human Relations
D51 Consumer Credit	OM1 Office Management Practices

Courses other than those listed above may be used for elective course credit upon approval of the Dean. Students should make certain that all prerequisite requirements have been satisfied before registering for courses.

RETAILING

Leading to the Degree of Bachelor of Science

semester hours

CORE COURSES — required..... 50

Accounting:		
A30-31	Managerial Accounting.....	4
Distribution:		
D1-2	Principles of Distribution.....	4
Economics:		
Ec1-2	Business Economics.....	4
Ec3-4	Financing Business Operations.....	4
Ec5-6	Financial Policies and Planning.....	4
English:		
E1-2	English and Business Communications.....	4
E3-4	Business Writing and Reports.....	4
Industrial Management:		
IM8-9	Production Planning and Control.....	4
Industrial Relations:		
IR20	Labor-Management Relations.....	2
Law:		
L1-2	Legal Aspects of Business I.....	4
L3-4	Legal Aspects of Business II.....	4
Mathematics:		
M2-3	Mathematics.....	4
Statistics:		
Ec20	Management Statistics.....	2
Ec21	Management Statistics — Business Applications.....	2

LIBERAL ARTS — required..... 24

LA1-2	Man and the Physical Universe	LA5-6	Man's Cultural Inheritance
LA3-4	Man in Society	LA7-8	Man and Values

PROFESSIONAL COURSES — required..... 29½

A32	Financial and Administrative Accounting.....	2½
D5	Principles of Salesmanship.....	2½
D10	Market Research.....	2½
D11	Marketing Management Seminar.....	2½
D20-21	Principles of Advertising.....	5
D50	Credit Fundamentals.....	2½
Ec23	Statistical Methods in Forecasting.....	2
Ec31	Managerial Economics.....	2½
R1	Retail Store Management.....	2½
R2	Retail Store Merchandising.....	2½
R3	Retail Store Advertising.....	2½

PROFESSIONAL COURSES — elective..... 26½

130

Selected from the following:

D6	Techniques of Salesmanship	Ec11	Economic Geography
D7	Sales Promotion	Ec12	Government Controls in Business
D8	Sales Management	Ec30	International Economics
D9	Sales Executive Training	E10	Effective Speaking for Business
D22	Advertising Problems	E12	Business Conferences
D23	Advertising Copy	IR1	Psychology for Business
D24	Advertising Production	IR4	Personnel Mgmt. Practices
D30-31	Foreign Trade	IR6	Employment Testing
D40	Purchasing	IR8	Techniques of Supervision
D52	Consumer Credit	OM3	Bus. Organization and Adm.
Ec7	Investment Principles	R4	Merch. Display for Sales Promo.

Courses other than those listed above may be used for elective course credit upon approval of the Dean. Students should make certain that all prerequisite requirements have been satisfied before registering for courses.

TRANSPORTATION AND TRAFFIC MANAGEMENT

Leading to the Degree of Bachelor of Science

semester hours

CORE COURSES — required..... 50

Accounting:		
A30-31	Managerial Accounting.....	4
Distribution:		
D1-2	Principles of Distribution.....	4
Economics:		
Ec1-2	Business Economics.....	4
Ec3-4	Financing Business Operations.....	4
Ec5-6	Financial Policies and Planning.....	4
English:		
E1-2	English and Business Communications.....	4
E3-4	Business Writing and Reports.....	4
Industrial Management:		
IM8-9	Production Planning and Control.....	4
Industrial Relations:		
IR20	Labor-Management Relations.....	2
Law:		
L1-2	Legal Aspects of Business I.....	4
L3-4	Legal Aspects of Business II.....	4
Mathematics:		
M2-3	Mathematics.....	4
Statistics:		
Ec20	Management Statistics.....	2
Ec21	Management Statistics — Business Applications.....	2

LIBERAL ARTS — required..... 24

LA1-2	Man and the Physical Universe	LA5-6	Man's Cultural Inheritance
LA3-4	Man in Society	LA7-8	Man and Values

PROFESSIONAL COURSES — required..... 30

A32	Financial and Administrative Accounting.....	2½
T1	Transportation Practices.....	2½
T2	Traffic Management.....	2½
T3	Adv. Traffic Management Problems.....	2½
T5	Ocean Transportation.....	2½
T6	Air Cargo Transportation.....	2½
T7	Transportation Insurance.....	2½
T9-10	ICC Practices.....	5
T14-15	Rates and Tariffs.....	5
T16	Commercial Warehousing.....	2½

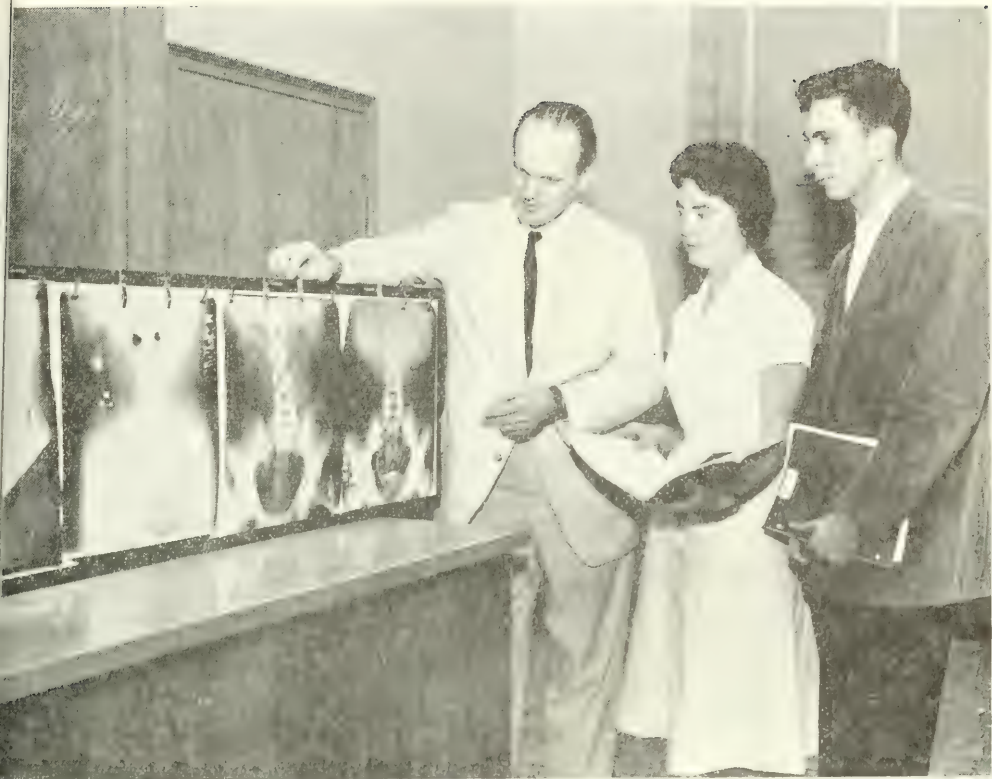
PROFESSIONAL COURSES — elective..... 26

130

Selected from the following:

D5	Principles of Salesmanship	IR2-3	Human Relations
D30-31	Foreign Trade	IR7	Practical Training Methods
D50	Credit Fundamentals	IR8	Techniques of Supervision
D51	Credit Problems	IR21	Lab. Leg. — Stds. & Cond. of Emp.
Ec11	Economic Geography	IR22	Lab. Leg. — Union-Mgmt. Relations
Ec12	Government Controls	IR23	Labor Agreement
Ec30	International Economics	T4	Selling Transportation Services
E10	Effective Speaking for Business	T8	Current Transportation Problems
E12	Business Conferences	T11	Motor Carrier Operations
Im40-41	Material Hndl. Fundamentals	T13	Freight Claims for Loss & Damage
IR1	Psychology for Business	T17	Adv. Transportation Economics

Courses other than those listed above may be used for elective course credit upon approval of the Dean. Students should make certain that all prerequisite requirements have been satisfied before registering for courses.



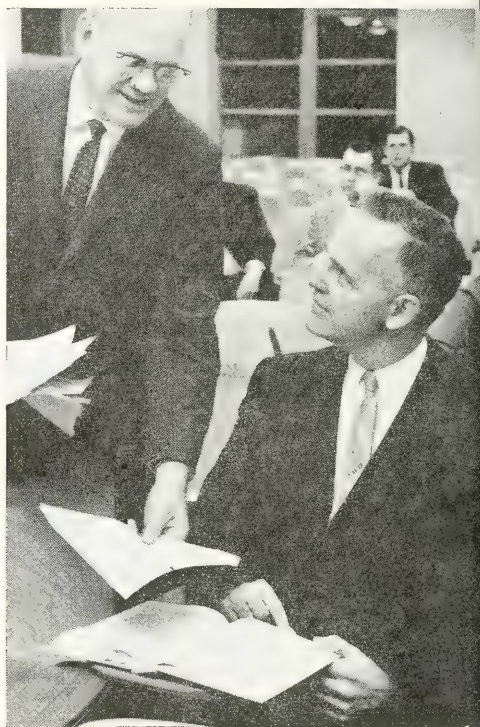
▲
Students enrolled in the X-Ray Technology course study examples of X-Ray development errors under the guidance of Dr. Leonard Sosman.

Dean Everett welcomes a trio of Springfield secretaries to the Seminar for Secretaries held at Andover Inn.



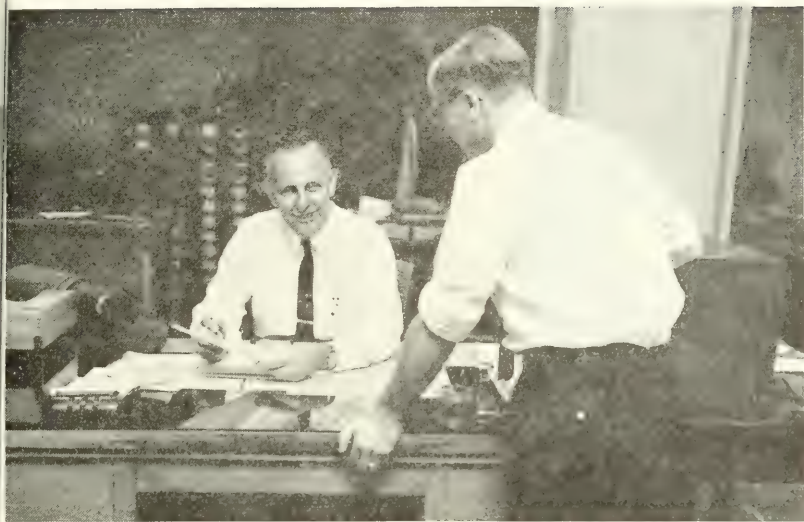
AN ADULT GOES TO COLLEGE . . .

. . . Edwin Gibson, Accounting major, ➤
discussing homework assignment with
Instructor John Olson.



. . . guidance and counseling — an in-
tegral part of every student's program.





... on the job.



... time out for studies.



... student becomes teacher as Ted and his wife Anne discuss Janet's geography lesson.





◀ . . . going to one of the University Dances, the Gibsons take a night off for relaxation.

. . . the big day arrives. Mr. Gibson presents the Certificate of Appreciation to his wife while Dean Everett smiles approval.



University College

Programs in Technology

CONSTRUCTION TECHNOLOGY

Leading to the Degree of Bachelor of Science

University College in co-operation with the Educational Committee of the Association of General Contractors has developed the following curriculum to serve the needs of those interested specifically in preparing for the field of construction. Based upon a foundation of civil engineering technology, it provides a concentration in modern construction equipment, methods and procedures with supporting courses in the general field of management. Students may enroll for individual courses, groups of courses or as degree candidates.

The total credit requirements for the degree are 130 semester hours of credit represented in the following curriculum:

<i>Course Number</i>		<i>Semester Hours</i>
801-2	Physics	6
601-2	Engineering Drawing	6
701-2	Engineering Mathematics	6
E1-2	English and Business Com.	4
201-2	Surveying I & II	6
703-4	Calculus	6
501-2	Applied Mechanics	6
203	Surveying III	3
204-5	Highway Eng. & Const.	6
219	Engineering Geology	3
503-4	Strength of Materials	6
301-2	Electrical Theory & Mach.	6
Ec1-2	Business Economics	4
204	Hydraulics	3
216	Foundation Engineering	3
901	Materials of Construction	3
217	Elements of Design	3
Ec3-4	Financing Bus. Operations	4
905	Quantity Surveys for Est.	3
906	Estimating Const. Costs	3
A30-31	Managerial Accounting	4
211-12	Sanitary Water & Sewg. Eng.	6
A38	Construction Cost. Account.	3
903	Build. Const. Proced. Meth.	6
904	Contracts & Specifications	3
907	Equipment and Methods	3
908	Arch. Treatment and Serv.	3
RE2	Real Estate Law	2½
IR20	Labor-Management Relations	2
909-10	Heavy Const. Proc. Meth.	6
902	Insurance - Const. Safety	3
911	Purchase Control of Mat.	3

INDUSTRIAL TECHNOLOGY

Leading to the Degree of Bachelor of Science

The Industrial Technology curriculum combines the fundamental courses in one of the several areas of engineering with an integrated program in management, the humanities and the social sciences to provide a broad background of training for those who aspire to positions of managerial responsibility where technical knowledge is required.

The curriculum is offered by University College in conjunction with the Lincoln Institute, one of the affiliated schools of Northeastern University. The technology requirements may be earned by satisfactory completion of equivalent courses in an accredited engineering college.

The total credit requirements for the degree are 130 semester hours distributed as follows:

Semester Hours

Technology Credits applicable from Associate Degree				60	
[Additional technical courses beyond the Associate Degree requirements, and not to exceed 10 semester hours, may be taken upon prior approval of the Dean of University College; credits so earned will substitute for management electives.]					
Management Courses — Required Core					
E1-2	English	4	A30-31	Managerial Acct.....	4
Ec1-2	Economics.....	4	Ec20	Management Statis..	2
Ec3	Finance I.....	2	IM20	Man. Statistics-Qual.	
IM8-9	Industrial Management ...	4		Control.....	2
L5	Law for Engineers....	2	IR1	Psych. for Bus. &	
IR20	Labor-Man. Rel.....	2		Ind. I.....	2½
				28½	
Liberal Arts — Required				24	
LA1-2	Man and the Physical Universe		LA5-6	Man's Cultural Inheritance	
LA3-4	Man in Society		LA7-8	Man and Values	
Management Courses — Electives					
(chosen from one of the options listed below)					
Total semester hours required for degree				17½	
				130	

OPTIONS

Production			Technical Sales		
		Semester Hours			Semester Hours
IM5	Work Simplification I.....	2½	Ec12	Government Controls.....	2½
IM2	Work Measurements I.....	2½	D1-2	Distribution, Prin.....	4
IM11	Production Processes.....	2½	D40	Purchasing.....	2½
IM40-41	Material Handling Fund.....	5	D5	Prin. of Salesmanship.....	2½
IM30-31	Plant Layout.....	5	D8	Sales Management.....	2½
Ec31	Managerial Economics.....	2½	D7	Sales Promotion.....	2½
IM15	Manufac. Mgmt. Seminar....	2½	T1	Transportation Practices....	2½
IM14	Materials Mgmt. Seminar....	2½	OM1	Office Management Practices..	2½
IR2-3	Human Relations.....	5	OM3	Business Org. & Admin.....	2½
OM3	Business Org. & Admin.....	2	D50	Credit Fundamentals.....	2½
Ec4	Finance II.....	2	IR2-3	Human Relations.....	5
			Ec4	Finance II.....	2
Administrative					
Ec12	Government Controls.....	2½	OM3	Business Org. & Admin.....	2½
IR2-3	Human Relations.....	5	D1-2	Distribution, Prin.....	4
In3	Insurance for Mgmt.....	2½	D40	Purchasing.....	2½
IR23	Labor Agreement.....	2½	D50	Credit Fundamentals.....	2½
IR21	Labor Leg. - Union-Mgt. Rel..	2½	OM15	Electronic Data Processes....	2½
Ec31	Managerial Economics.....	2½	OM16	Electronic Data Programming	2½
OM1	Office Management Practices..	2½			

Courses other than those shown above may be taken upon approval of the Dean if they are consistent with the student's educational pattern.

MANUFACTURING TECHNOLOGY

Leading to Degree of Bachelor of Science

The dynamic changes taking place in the areas of manufacturing and materials management bring into sharp focus the necessity for effective co-ordination of all of the contributing elements from research and development to shipment of the finished product. The program in Manufacturing Technology designed upon a foundation of engineering courses integrates the several areas of organization, production, distribution, finance, industrial relations and controls with special emphasis on the factors in the manufacturing process which deal with the materials aspect. This is one of the newer curricula to be made available by University College to recognize this development in industry. The engineering requirements will be completed through Lincoln Institute. However, satisfactory completion of equivalent courses will be accepted from any accredited engineering college.

The total credit requirements for the degree are 130 semester hours distributed as follows:

		Semester Hours *60
Technical Courses — Required		
701-2	Algebra — Trigonometry	6
703-4	Anal. Geometry — Calculus	6
801-2	Physics	6
601-2	Engineering Drawing	6
501-2	Applied Mechanics	6
603-4	Machine Drawing	6
503-4	Strength of Materials	6
508-9	Machine Design	6
301-2	D-C, A-C Theory	6
303-4	D-C, A-C Machinery	6

*Students may elect 10 additional semester hours of work in technical subjects to be applied against the management-technical electives.

Industrial Management Courses — Required		36
IM5	Work Simplification I	2½
IM2	Work Measurements I	2½
IM11	Production Processes	2½
IM10	Materials of Production	2½
IM40-41	Material Handling	5
IM14	Materials Management	2½
IM15	Manufacturing Management	2½
Ec1-2	Business Economics	4
E1-2	English and Bus. Comm.	4
Ec20	Management Statistics	2
IM20	Quality Control	2
IM8-9	Production Planning and Control	4

Liberal Arts — Required		24
LA1-2	Man and the Physical Universe	LA5-6 Man's Cultural Inheritance
LA3-4	Man in Society	LA7-8 Man and Values

**Management and Technical Courses — Electives		10
507	Mechanisms..... 3	A30-31 Managerial Accounting... 4
305	Electronics in Industry..... 3	Ec31 Managerial Economics ... 2½
204	Hydraulics..... 3	A33 Mgmt. Cost Controls.... 2½
505-6	Heat Engineering..... 6	Ec3-4 Financing Bus. & Ind.... 4
551-2	Mech. Eng. Laboratory..... 6	L1-2 Legal Aspects of Bus. I.... 4
		IM50 Procurement-Inv. Cont.... 4

**Courses other than those suggested as electives may be taken upon approval of the Dean if they are consistent with the student's educational pattern.

SURVEYING TECHNOLOGY

Leading to the Degree of Bachelor of Science

The science of surveying is undergoing considerable change in terms of complexity of methods, equipment and procedures. It precedes and is integrated into all construction projects. Its relation to all forms of surface and depth measurements makes it of irreplaceable importance as it precedes and controls all forms of construction. The concurrent trend toward concentration upon design in civil engineering curricula makes this program, especially related to the science of surveying, a necessity to adequately prepare those planning to enter this field as well as to make available a source of information to keep those practicing in the field professionally current with developments.

Requirements for the degree are 130 semester hours represented in the following curriculum:

801-2	Physics	6
601-2	Engineering Drawing	6
701-2	Engineering Mathematics	6
E1-2	English and Business Comm.	4
201-2	Surveying I & II	6
703-4	Calculus	6
501-2	Applied Mechanics	6
203	Surveying III	3
204-5	Highway Engineering	6
221	Map Projections	3
503-4	Strength of Materials	6
301-2	Electrical Theory & Mach.	6
LA1-2	Man's Physical Universe	6
303	Electronic Circuits	3
101-2	General Chemistry	6
220	Geodesy	3
LA2-3	Man and Society	6
223-4	Photogrammetry Lab I & II	6
204	Hydraulics	3
215	Geology & Soils — Eng. Geol.	3
LA5-6	Man's Cultural Heritage	6
225	Photogrammetry Lab	3
211-12	Sanitary Engineering	6
216	Foundation Engineering	3
LA7-8	Man and Values	6
230	City & Regional Planning	3
OM15-16	Computers	6
RE2	Real Estate Law	2½
E10	Effective Speaking	2½
E3-4	Report Writing	4



. . . Registration in the offices of University College.



Dr. Lois Kachenmeister explains the intricacies of a hair follicle to her students in a course in Anatomy.

University College

*Combined Programs in
Liberal Arts and Management*

COMBINED PROGRAMS IN LIBERAL ARTS AND MANAGEMENT

Leading to the Degree of Bachelor of Science

There are several areas of employment which require as preparatory training a natural combination of liberal arts with business courses. To meet this need the Evening College of Liberal Arts offers in conjunction with University College a program leading to the degree of Bachelor of Science.

The degree requires satisfactory completion of three years of study in liberal arts (72 semester hours of credit) plus fifty (50) semester hours of credit in management courses. The following programs, as represented in the several options, are designed to provide the most adequate preparation for the specific areas of work.

ADMINISTRATION

Leading to the Degree of Bachelor of Science

*Liberal Arts Courses:

		<i>Semester Hours</i>
English	4	
Fine Arts	4	
Government	6	
History	8	
Literature	8	
Philosophy	4	
Psychology	8	
Science	6	
Sociology	6	
Elective Courses	<u>18</u>	72

Management Courses

A30-31	Managerial Accounting	4	
A32	Financial & Administrative Accounting	2½	
D1-2	Principles of Distribution	4	
D40	Purchasing	2½	
D50	Credit Fundamentals	2½	
Ec1-2	Business Economics	4	
Ec3-4	Financing Business Operations	4	
Ec5-6	Financial Policy and Planning	4	
Ec20-21	Management Statistics	4	
Ec34-35	Business Planning and Research	5	
IN3	Insurance for Management	2½	
IR20	Labor-Management Relations	2	
L1-2	Legal Aspects of Business I	4	
L3-4	Legal Aspects of Business II	4	
OM1	Office Management Practices	2½	
OM3	Business Organization & Administration	2½	
	Elective Courses	<u>4</u>	58
	Total Semester Hours Required for Degree		<u>130</u>

*Courses in the Liberal Arts for this program are taken through evening course offerings in the College of Liberal Arts.

PERSONNEL AND INDUSTRIAL RELATIONS

Leading to the Degree of Bachelor of Science

Liberal Arts CoursesSemester Hours*

English	4	
Fine Arts	4	
Government	6	
History	8	
Literature	8	
Philosophy	4	
Psychology	12	
Science	6	
Sociology	8	
Elective Courses	<u>12</u>	72

Management Courses:

A30-31	Managerial Accounting	4	
A32	Financial & Administrative Accounting	2½	
Ec1-2	Business Economics	4	
Ec3-4	Financing Business Operations	4	
Ec5-6	Financial Policy and Planning	4	
Ec20-21	Management Statistics	4	
IM2	Work Measurements I	2½	
IM7	Job Analysis and Evaluation	2½	
IR4	Personnel Management Practices	2½	
IR6	Employment Testing	2½	
IR7	Practical Training Methods	2½	
IR20	Labor-Management Relations	2	
IR21	Labor Leg.-Union-Mgmt. Relations	2½	
IR22	Labor Leg.-Standards and Conditions	2½	
IR23	Labor Agreement	2½	
L1-2	Legal Aspects of Business I	4	
L3-4	Legal Aspects of Business II	4	
	Elective Courses	<u>5½</u>	58
	Total Semester Hours Required for Degree		<u>130</u>

*Courses in the Liberal Arts for this program are taken through evening course offerings in the College of Liberal Arts.

SALES

Leading to the Degree of Bachelor of Science

Liberal Arts CoursesSemester Hours*

English	4	
Fine Arts	4	
Government	6	
History	8	
Literature	8	
Philosophy	4	
Psychology	8	
Science	6	
Sociology	8	
Elective Courses	<u>16</u>	72

Management Courses:

A30-31	Managerial Accounting	4	
D1-2	Principles of Distribution	4	
D5	Principles of Salesmanship	2½	
D7	Sales Promotion	2½	
D10	Market Research	2½	
D20-21	Principles of Advertising	5	
D50	Credit Fundamentals	2½	
Ec1-2	Business Economics	4	
Ec3-4	Financing Business Operations	4	
Ec5-6	Financial Policy and Planning	4	
Ec12	Government Controls	2½	
Ec20-21	Management Statistics	4	
Ec31	Managerial Economics	2½	
L1-2	Legal Aspects of Business I	4	
L3-4	Legal Aspects of Business II	4	
	Elective Courses	<u>6</u>	58
	Total Semester Hours Required for Degree		<u>130</u>

*Courses in the Liberal Arts for this program are taken through evening course offerings in the College of Liberal Arts.

University College

Institute Programs
Certificates Awarded

Credit and Financial Management Institute

Business Management and the public are becoming increasingly aware of the responsibilities and professional obligations of the credit executive, whose work covers every important area of commercial and industrial activity. Credit dispositions affect the economic, social and moral welfare of peoples of all levels of our national life.

For the persons aspiring to a career in credit management, training on a professional level is a necessity. The program offered in the Credit and Financial Management Institute and through the B.S. Degree Curriculum is designed to qualify credit office personnel and others, whose interests and work are indirectly related to credit functions, for posts of greater responsibility and trust.

The Boston Chapter, National Institute of Credit, co-operates with the University College, Northeastern University, in sponsoring these courses of training. Satisfactory completion of the courses prepares the students for the examination to qualify for the Awards of Associate and Fellow of the National Institute of Credit. Examinations are set and given by the National Institute. Students are asked to consult with the Dean for details of the examinations and awards.

The Certificate Program

The Certificate requires the completion in University College of forty (40) semester hours of credit from courses listed below. Students who can establish proficiency in any of the required courses through practical experience, or who have completed any of them previously in another institution, may substitute other related courses upon approval of the Dean.

Required Courses

<i>Course Numbers</i>	<i>Courses</i>	<i>Semester Hours of Credit</i>
A30-31	Managerial Accounting	4
Ecl-2	Business Economics	4
Ec3-4	Financing Business Operations	4
E10	Effective Speaking for Business	2½
D5	Principles of Salesmanship	2½
D50	Credit Fundamentals	2½
D51	Credit Problems	2½
L1-2	Legal Aspects of Business I	4
L3-4	Legal Aspects of Business II	4

Elective Courses

A34	Analysis of Financial Statements	2½
D1-2	Principles of Distribution	4
D30-31	Foreign Trade	5
D40	Purchasing	2½
Ec5-6	Financial Policy and Planning	4
E1-2	English and Business Communications	4
IR1	Psychology for Business	2½
IR8	Techniques of Supervision	2½
OM1	Office Management Practices	2½

B.S. Degree

Credits earned in any of the above courses may be applied toward the semester hours required for the B.S. degree. Students registering for this program should consult with the Dean to arrange a program of courses which will most adequately satisfy their training needs.

Institute of Distribution

The broad field of distribution represents a facet of our economy which possesses great challenges and opportunities. The serving of current needs and the creation of new markets are fundamental to the welfare and progress of our society. Changes are in constant process in this dynamic field. Some of the major reductions in cost of materials to the consumer demanded by our competitive system will result in the development of more effective procedures requiring highly trained personnel.

The Institute of Distribution represents a program of basic courses for persons employed in as well as for those seeking opportunities in one of its several branches.

The student may enroll for one or more individual courses, complete the requirements of the Certificate Program, or use the credits earned toward the B.S. degree.

The Certificate Program

The Certificate requires the completion in University College of thirty (30) semester hours of credit from courses listed below. Students who can establish proficiency in any of the required courses through practical experience, or who have completed any of them previously in another institution, may substitute other related courses upon approval of the Dean.

Required Courses

<i>Course Numbers</i>	<i>Courses</i>	<i>Semester Hours of Credit</i>
D1-2	Principles of Distribution	4
D-5	Principles of Salesmanship	2½
D20-21	Principles of Advertising	5
T1	Transportation Practices	2½

Elective Courses

D6	Techniques of Salesmanship	2½
D7	Sales Promotion	2½
D8	Sales Management	2½
D9	Sales Executive Training	2½
D10	Market Research	2½
D22	Advertising Problems	2½
D23	Advertising Copy	2½
D25	Advertising Media	2½
D26	Direct Mail Advertising	2½
D40	Purchasing	2½
D41	Consumer Packaging	2½
D50	Credit Fundamentals	2½
D52	Consumer Credit	2½
R1	Retail Store Management	2½
R2	Retail Store Merchandising	2½
R4	Merchandise Display for Sales Promotion	2½
T2	Traffic Management	2½

B.S. Degree

Credits earned in any of the above courses may be applied toward the semester hours required for the B.S. degree. Students registering for this program should consult with the Dean to arrange a program of courses which will most adequately satisfy their training needs.

Institute of Industrial and Commercial Material Handling

Material Handling represents the main frontier in production for cost reduction. The potentials are evident when it is estimated by many authorities that in the average plant —

- ... 50 tons of material are moved for every ton of finished product
- ... handling costs up to 25 cents of every manufacturing dollar
- ... 25% of all industrial accidents are attributable to material handling

The Institute provides a vigorous and forward-looking program of practical training for those currently employed in material handling sales, engineering, administration or other related areas of production and distribution. The program is designed to help meet the need for personnel trained in this important phase of industrial activity.

The student may select an individual course, complete the requirements of the Certificate Program, or use the credits earned toward the B.S. Degree Curriculum in Production Management — Industrial and Commercial Material Handling.

The Certificate Program

The Certificate requires the completion in University College of thirty (30) semester hours of credit from courses listed below. Students who can establish proficiency in any of the required courses through practical experience, or who have completed any of them previously in another institution, may substitute other related courses upon approval of the Dean.

Required Courses

<i>Course Numbers</i>	<i>Courses</i>	<i>Semester Hours of Credit</i>
1M5	Work Simplification I	2½
1M8-9	Production Planning and Control	4
1M40-41	Material Handling Fundamentals	5
1M42	Material Handling — Problem Analysis	2½
1M43	Material Handling — Cost Determination	2½
1M44	Material Handling — Engineering Principles	2½

Elective Courses

A30-31	Managerial Accounting	4
D40	Purchasing	2½
D42	Industrial Packing and Packaging	2½
M2-3	Mathematics	4
1M11	Production Processes	2½
1M13	Industrial Safety	2½
1M30-31	Plant Layout	5
1M45	Material Handling — Conveyorization	2½
1M46	Material Handling — Commercial Carriers	2½
1M47	Material Handling — Industrial Warehousing	2½
1M48	Material Handling — Yard Handling	2½
1M49	Material Handling — In-Process Handling	2½
1M50	Material Handling — Multi-story Buildings	2½
1M51	Material Handling — Bulk Materials	2½

B.S. Degree

Credits earned in any of the above courses may be applied toward the semester hours required for the B.S. degree. Students registering for this program should consult with the Dean to arrange a program of courses which will most adequately satisfy their training needs.

Institute of Insurance

Designed to meet a demand for a practical approach to the basic principles and practices of current procedures and operations in the field of insurance, the Institute of Insurance offers an integrated program of courses, each closely interrelated with the appropriate policy forms, endorsements and manuals.

These courses should prove of especial value to office workers in insurance companies as a preparation for advancement or for those who may be employed as or who plan to train to become agents, brokers, fieldmen or underwriters.

The complete program including thirty (30) semester hours may be completed in two academic years. The courses will include those listed below as required courses, plus other elective courses to make a total of thirty (30) semester hours.

The Certificate Program

The Certificate requires the completion in University College of thirty (30) semester hours of credit from courses listed below. Students who can establish proficiency in any of the required courses through practical experience, or who have completed any of them previously in another institution, may substitute other related courses upon approval of the Dean.

Required Courses

<i>Course Numbers</i>	<i>Courses</i>	<i>Semester Hours of Credit</i>
In1-2	Insurance Principles	5
In4-5	Casualty Insurance	5
In6-7	Fire and Allied Lines	5
In8-9	Inland Marine Insurance	5
In10-11	Fidelity, Suretyship and Crime	5

Elective Courses

A30-31	Managerial Accounting	4
D5	Principles of Salesmanship	2½
Ec1-2	Business Economics	4
Ec3-4	Financing Business Operations	4
Ec20-21	Management Statistics	4
E10	Effective Speaking for Business	2½
IM13	Industrial Safety	2½
In13-14	Claims Procedure	5
L12-3-4	Legal Aspects of Business I-II	8

B.S. Degree

Credits earned in any of the above courses may be applied toward the semester hours required for the B.S. degree. Students registering for this program should consult with the Dean to arrange a program of courses which will most adequately satisfy their training needs.

Institute of Retailing

Rapid changes have come about in the distribution of merchandise. This is especially true in the retail store phase of the field. During recent years, many factors such as rapidity of style changes, the increase in size of retail stores and the keenness of competition have helped to make the management of a retail business more complex and difficult. Progressive stores have already done considerable in the nature of applying the scientific approach to some of these problems. In such a fast moving field, the store management is constantly in search of those who are qualified through adequate training and experience to assume responsibility and authority.

The courses included in the Institute of Retailing are designed to provide an integrated program of study for men and women who desire to train for positions of managerial responsibility in the field of retailing. Students may register for single courses or for the complete programs.

The Certificate Program

The Certificate requires the completion in University College of thirty (30) semester hours of credit from courses listed below. Students who can establish proficiency in any of the required courses through practical experience, or who have completed any of them previously in another institution, may substitute other related courses upon approval of the Dean.

Required Courses		
<i>Course Numbers</i>	<i>Courses</i>	<i>Semester Hours of Credit</i>
D1-2	Principles of Distribution	4
D5	Principles of Salesmanship	2½
D20-21	Principles of Advertising	5
D52	Consumer Credit	2½
Ec1-2	Business Economics	4
Ec20	Management Statistics	2
R1	Retail Store Management	2½
R2	Retail Store Merchandising	2½
R3	Retail Store Advertising	2½
R4	Merchandise Display for Sales Promotion	2½

B.S. Degree

Credits earned in any of the above courses may be applied toward the semester hours required for the B.S. degree. Students registering for this program should consult with the Dean to arrange a program of courses which will most adequately satisfy their training needs.

Institute of Transportation and Traffic Management

Transportation as a phase of the distribution of raw materials and processed merchandise is assuming a degree of major importance in our American economy. The flexibility of the trucking industry is changing many of our concepts of inventories and methods of operation. This, plus the cost factor, requires effective management of the handling and shipment of goods.

Two standards of professional achievement exist today in the field of Transportation and Traffic Management. One is admission to practice before the bar of the Interstate Commerce Commission; the other is admission to the American Society of Traffic and Transportation, Inc. Examinations for the former are given twice yearly by the Interstate Commerce Commission. Successful completion of the examination qualifies one to present cases and represent clients before the Commission. Examinations for the latter are announced periodically by the association. Successful completion of the examination carries with it a certificate of accomplishment that is very highly regarded in the fields of Transportation and Traffic Management.

The Institute program outlined below is designed to accomplish two objectives: (1) Provide an intensive training in the fields of Transportation and Traffic Management, as well as a supplementary background in the broader aspects of business administration; (2) prepare individuals specifically for the two examinations discussed above. The courses marked with an asterisk (*) are those most necessary for this preparation.

The Certificate Program

The Certificate requires the completion in University College of thirty (30) semester hours of credit from courses listed below. Students who can establish proficiency in any of the required courses through practical experience, or who have completed any of them previously in another institution, may substitute other related courses upon approval of the Dean.

Required Courses

<i>Course Numbers</i>	<i>Courses</i>	<i>Semester Hours of Credit</i>
T1	Transportation Practices	2½
T2	*Traffic Management	2½
T3	*Advanced Traffic Management Problems	2½
T9-10	*I.C.C. Practices and Procedures	5
T13	*Freight Claims for Loss and Damage	2½
T14-15	*Rates and Tariffs	5

Elective Courses

D42	Industrial Packaging and Packing	2½
Ec1-2	*Business Economics	4
Ec12	*Government Controls in Business	2½
L1-2-3-4	Legal Aspects of Business I-II	8
T4	Selling Transportation Services	2½
T5	Ocean Transportation	2½
T6	Air Cargo Transportation	2½
T7	Transportation Insurance	2½
T11	Motor Carrier Operations	2½
T12	Motor Carrier Traffic Management	2½
T16	Commercial Warehousing	2½
T17	*Advanced Transportation Economics	2½

B.S. Degree

Credits earned in any of the above courses may be applied toward the semester hours required for the B.S. degree. Students registering for this program should consult with the Dean to arrange a program of courses which will most adequately satisfy their training needs.

Labor Relations Institute

The management of labor relations presents the most vital and challenging aspect of our industrial development of the immediate future. Continuance of our American way of industrial democracy demands a harmonious understanding of the underlying principles of labor and industrial management for the peaceful adjustment of their common problems.

The Labor Relations Institute of Northeastern University was organized to serve this need. It is dedicated to the service of both labor and management. It directly concerns the work of industrial and labor executives, plant managers, personnel directors, union shop councillors and stewards.

Students may register for the complete program or may take any one or more of the courses which serve their particular needs. They may complete the entire program by attending three evenings per week for two years. Each individual course is one semester or sixteen weeks in length and carries either two or two and one-half semester hours of credit for students qualified for the degree programs of University College.

The Certificate Program

The Certificate requires the completion in University College of thirty (30) semester hours of credit from courses listed below. Students who can establish proficiency in any of the required courses through practical experience, or who have completed any of them previously in another institution, may substitute other related courses upon approval of the Dean.

Required Courses

<i>Course Numbers</i>	<i>Courses</i>	<i>Semester Hours of Credit</i>
Ec1-2	Business Economics	4
IR20	Labor-Management Relations	2
IR21	Labor Legislation — Union-Management Relations	2½
IR22	Labor Legislation — Standards and Conditions of Emp.	2½
IR23	Labor Agreement — Negotiation and Administration	2½
IR24	Labor Relations Seminar	2½

Elective Courses

A30-31	Managerial Accounting	4
E10	Effective Speaking for Business	2½
E12	Business Conferences	2½
IM2	Work Measurements I	2½
IM3	Work Measurements II	2½
IM5	Work Simplification I	2½
IM6	Work Simplification II	2½
IM7	Job Analysis and Evaluation	2½
IM13	Industrial Safety	2½
IR1	Psychology for Business	2½
IR2-3	Human Relations	5
IR4	Personnel Management Practices	2½
IR5	Wage Administration	2½
IR6	Employment Testing	2½
IR7	Practical Training Methods	2½

B.S. Degree

Credits earned in any of the above courses may be applied toward the semester hours required for the B.S. degree. Students registering for this program should consult with the Dean to arrange a program of courses which will most adequately satisfy their training needs.

Office Management Institute

The profession of office management has developed rapidly in scope and status in response to the technical and diversified nature of the problems arising and the current trends toward the scientific approach to the solutions of these problems. Heretofore, the efforts toward simplified work procedures have been related primarily to the plant ends of production. Its extension to office procedures is vital to the necessary reduction of the ever-mounting overhead created by increased costs.

The Office Management Institute is designed to serve those already employed in the field by providing instruction necessary for simplification and standardization of their operational tasks. The courses should have an appeal for systems analysts, accountants, office managers, sales managers, engineers, comptrollers, etc. It also provides a formal and planned program of training for those intending to make their careers in this profession.

The student may select an individual course, complete the requirements of the Certificate Program or use the credits earned toward the B.S. degree.

The Certificate Program

The Certificate requires the completion in University College of thirty (30) semester hours of credit from courses listed below. Students who can establish proficiency in any of the required courses through practical experience, or who have completed any of them previously in another institution, may substitute other related courses upon approval of the Dean.

Required Courses

<i>Course Numbers</i>	<i>Courses</i>	<i>Semester Hours of Credit</i>
A30-31	Managerial Accounting	4
IR8	Techniques of Supervision	2½
OM1	Office Management Practices	2½
OM2	Scientific Management in Office Practice	2½
OM10	Office Systems and Procedure	2½
OM11	Forms Design and Control	2½

Elective Courses

A37	Punch Card Accounting	2½
Ec20-21	Management Statistics	4
E1-2	English and Business Communications	4
E12	Business Conferences	2½
IR2-3	Human Relations	5
IR5	Wage Administration	2½
IR6	Employment Testing	2½
IR7	Practical Training Methods	2½
IR20	Labor-Management Relations	2
OM12	Systems Analysis and Improvement	2½
OM15	Electronic Data Processing Systems	2½

B.S. Degree

Credits earned in any of the above courses may be applied toward the semester hours required for the B.S. degree. Students registering for this program should consult with the Dean to arrange a program of courses which will most adequately satisfy their training needs.

Production Management Institute

The Production Management Institute presents an integrated program of courses for those specifically related to or interested in the plant ends of manufacturing. With each course designed to treat the subject matter in detail and thereby stand alone as a unit, the program achieves integration by the use of projects which carry through the several courses in sequence, developing a complete picture of the methods and procedure encountered in the over-all practical problems of production. This integration makes possible the thorough study of a highly technical field with limitless detail which otherwise could be approached only in a superficial manner.

This program should have direct value to those currently employed in one of the several operating manufacturing departments as well as those who wish to plan for careers in this area of management.

The student may select an individual course, complete the requirements of the Certificate Program or use the credits earned toward the B.S. degree.

The Certificate Program

The Certificate requires the completion in University College of thirty (30) semester hours of credit from courses listed below. Students who can establish proficiency in any of the required courses through practical experience, or who have completed any of them previously in another institution, may substitute other related courses upon approval of the Dean.

Required Courses

<i>Course Numbers</i>	<i>Courses</i>	<i>Semester Hours of Credit</i>
A30-31	Managerial Accounting	4
M2-3	Mathematics	4
IM5	Work Simplification I	2½
IM8-9	Production Planning and Control	4
IM11	Production Processes	2½
IM12	Estimating for Production	2½

Elective Courses

Ec20	Management Statistics	2
IM2	Work Measurements I	2½
IM4	Synthetic Time Standards — M.T.M.	2½
IM6	Work Simplification II	2½
IM7	Job Analysis and Evaluation	2½
IM10	Materials of Production	2½
IM13	Industrial Safety	2½
IM20	Quality Control	2
IM30-31	Plant Layout	5
IM40-41	Material Handling Fundamentals	5
IM42	Material Handling Problems	2½
IR2-3	Human Relations	5
IR7	Practical Training Methods	2½
IR8	Techniques of Supervision	2½
IR20	Labor-Management Relations	2
IR23	Labor Agreement — Negotiations and Administration	2½

B.S. Degree

Credits earned in any of the above courses may be applied toward the semester hours required for the B.S. degree. Students registering for this program should consult with the Dean to arrange a program of courses which will most adequately satisfy their training needs.

Quality Control Institute

The application of statistical methods to the control of quality — a comparatively new management tool — has produced significant results in:

- Improved quality of manufactured product**
- Increased productivity of labor and machines**
- Reduction in scrap, rework, tool and machine down-time costs**
- Decrease in rejects**
- Increased effectiveness of supervision**
- Improved quality of purchased materials**
- Providing of scientific analysis of product specification**

Quality Control has effective application to both large and small organizations. It warns when trouble is imminent and tells where and when to look for the source of the trouble. It indicates when a process should be changed for increased economy. By appropriate sampling techniques it provides a constant control of materials used, the production processes and the inspection of the final product, resulting in reduction of costs and the production of a higher percentage of acceptable units.

The courses are designed to serve persons specializing in *Quality Control* or those wishing to include it in the Degree Program in Production Management.

The Certificate Program

The Certificate requires the completion in University College of thirty (30) semester hours of credit from courses listed below. Students who can establish proficiency in any of the required courses through practical experience, or who have completed any of them previously in another institution, may substitute other related courses upon approval of the Dean.

Required Courses

Course Numbers	Courses	Semester Hours of Credit
Ec20	Management Statistics	2
M2-3	Mathematics	4
IM10	Materials of Production	2½
IM20	Quality Control	2
IM21	Advanced Quality Control	2½
IM22	Management of Quality Control	2½
IM23	Quality Control Seminar	2½
IM32	Industrial Experimentation I	2½

Elective Courses

M4-5	Graphic and Mathematical Techniques in Industry	4
IM5	Work Simplification I	2½
IM6	Work Simplification II	2½
IM8-9	Production Planning and Control	4
IM11	Production Processes	2½
IR1	Psychology for Business	2½
IR8	Techniques of Supervision	2½

B.S. Degree

Credits earned in any of the above courses may be applied toward the semester hours required for the B.S. degree. Students registering for this program should consult with the Dean to arrange a program of courses which will most adequately satisfy their training needs.

Real Estate Institute

The social and economic importance of real estate has been impressed upon us since World War II. Conditions in the field have changed rapidly since that time to the extent that real estate is no longer a local phenomenon but rather a national problem. It becomes increasingly important, therefore, that persons be trained in the economics as well as the legal and financial problems for either personal use or for operational purposes as brokers, financiers, managers, investors or land planners.

The courses comprising the Institute of Real Estate are designed as practical tool courses for those training for or directly associated with concerns actively engaged in real estate ownership, conveyancing and management as lawyers, real estate agents and brokers, property managers, conveyancers, builders, municipal land planners or employees of banks, insurance companies and other financial institutions with major investments in real estate.

The Certificate Program

The Certificate requires the completion in University College of thirty (30) semester hours of credit from courses listed below. Students who can establish proficiency in any of the required courses through practical experience, or who have completed any of them previously in another institution, may substitute other related courses upon approval of the Dean.

Required Courses

<i>Course Numbers</i>	<i>Courses</i>	<i>Semester Hours of Credit</i>
A30-31	Managerial Accounting	4
RE1	Real Estate Fundamentals	2½
RE2	Real Estate Law and Conveyancing	2½
RE3	Real Estate Management	2½
RE4	Real Estate Finance	2½
RE5	Real Estate Sales and Advertising	2½
RE6	Operating a Real Estate Business	2½
RE7	Real Estate Appraisal — Residential	2½
RE8	Real Estate Appraisal — Commercial and Industrial	2½

Elective Courses

D1-2	Principles of Distribution	4
D5	Principles of Salesmanship	2½
D20-21	Principles of Advertising	5
Ec1-2	Business Economics	4
Ec20-21	Management Statistics	4
E10	Effective Speaking for Business	2½
L1-2-3-4	Legal Aspects of Business I-II	8
RE9	Small Home Construction and Estimating	2½

B.S. Degree

Credits earned in any of the above courses may be applied toward the semester hours required for the B.S. degree. Students registering for this program should consult with the Dean to arrange a program of courses which will most adequately satisfy their training needs.

University College

Programs for Administrative Secretaries

Institute for Business and Professional Secretaries

Today, more than ever, with the increased tempo of modern production, business and industry are looking toward qualified women to assume positions of administrative responsibility. To meet these needs women with secretarial training may supplement this background with further knowledge and information through professional courses related to the operations of their respective departments or organizations. The combination of proficiency in the secretarial sciences with training through specialized courses related to their fields of employment considerably enhances their value and provides the avenue for advancement into positions of major importance with higher salaries. For those who have not had previous instruction in secretarial science, such courses will be included in their programs. Advanced standing credit, up to a maximum of fifteen (15) semester hours, may be awarded to those who have satisfactorily completed courses elsewhere and/or can achieve satisfactory performance in the secretarial sciences through proficiency examinations.

Students may register for individual courses, complete the requirements of forty-five (45) semester hours for the Certificate or apply the credits earned toward the B.S. degree.

The program for each student will be recommended and planned on an individual conference basis. In each case, however, there will be a core of basic required courses which will be supplemented by elective courses selected to serve most adequately the student's specific needs. Each student must have completed a basic course in Shorthand and Typewriting at an approved school as a requirement of admission to this Institute program. Certain suggested programs are outlined below.

Required Courses

Course No.		Semester Hours	Course No.		Semester Hours
A30-31	Managerial Accounting . . .	4	E3-4	Bus. Writing and Reports . .	4
Ec1-2	Business Economics	4	IR1	Psychology for Business . . .	2½
E1-2	English and Bus. Comm. . . .	4	OM1	Office Mgmt. Practices	2½
			OM2	Scientific Mgmt. in Off. Prac.	2½

Suggested Electives in Specialized Areas

Accounting

A32	Fin. and Adm. Acct.	2½
A33	Mgrl. Cost Controls	2½
A50-51	Basic Federal Taxes	5
Ec3-4	Financing Bus. Operations . .	4
Ec12	Government Controls	2½
L1-2-3-4	Legal Aspects of Bus. I-II . .	8

Finance

A34	Anal. Fin. Statements	2½
Ec3-4	Fin. Business Operations . . .	4
Ec5-6	Fin. Policy & Planning	4
Ec7	Investment Principles	2½
Ec20-21	Management Statistics	4
Ec32	Monetary Policy	2½
Ec34-35	Business Plng. & Research . .	5

Credit Management

A34	Anal. Fin. Statements	2½
D50	Credit Fundamentals	2½
D51	Credit Problems	2½
D52	Consumer Credit	2½
Ec3-4	Financing Bus. Operations . .	4
Ec5-6	Fin. Pol. & Planning	4
L1-2-3-4	Legal Aspects of Bus. I-II . .	8

Engineering

Ec20	Management Statistics	2
M2-3	Mathematics	4
IM5	Work Simplification I	2½
IM8-9	Prod. Planning Control	4
IM10	Matls. of Prod.	2½
IM11	Production Processes	2½
IM20	Quality Control	2

Advertising

D1-2	Principles of Distribution . . .	4
D5	Principles of Salesmanship . .	2½
D7	Sales Promotion	2½
D10	Market Research	2½
D20-21	Prin. of Advertising	5
D23	Advertising Copy	2½
D24	Advertising Production	2½
D25	Advertising Media	2½
D41	Consumer Packaging	2½
R3	Retail Store Advertising . . .	2½
R4	Merchandise Display	2½

Foreign Trade

D1-2	Principles of Distribution . . .	4
D10	Market Research	2½
D30-31	Foreign Trade	5
Ec3-4	Fin. Business Operations . . .	4
Ec11	Economic Geography	2½
Ec20-21	Management Statistics	4
Ec30	International Economics . . .	2½
L1-2-3-4	Legal Aspects of Bus. I-II . .	8

Course No.	Semester Hours
Insurance	
Ec20-21 Management Statistics.....	4
In1-2 Insurance Principles.....	5
In4-5 Casualty Insurance.....	5
In6-7 Fire and Allied Lines.....	5
In8-9 Inland Marine.....	5
In10-11 Fidelity, Surety & Crime Ins.	5
In13-14 Claims Procedure.....	5
IR2-3 Human Relations.....	5
L1-2-3-4 Legal Aspects of Bus. I-II...	8

Law	
A50-51 Basic Federal Taxes.....	5
Ec12 Government Controls.....	2½
L1-2-3-4 Legal Aspects of Bus. I-II...	8
RE1 Real Estate Fundamentals...	2½
RE2 R.E. Law & Convey.....	2½

Office Management

D40 Purchasing.....	2½
D50 Credit Fundamentals.....	2½
IM7 Job Analysis and Evaluation	2½
IR2-3 Human Relations.....	5
IR6 Employment Testing.....	2½
IR7 Practical Training Methods.	2½
IR8 Techniques of Supervision.	2½
OM1 Office Mgmt. Practices.....	2½
OM10 Office Systems & Procedures	2½
OM11 Forms Design.....	2½

Personnel and Industrial Relations

Ec20-21 Management Statistics.....	4
IM2 Work Measurements I.....	2½
IM7 Job Analysis and Evaluation	2½
In4-5 Casualty Insurance.....	5
IR2-3 Human Relations.....	5
IR4 Personnel Mgmt. Practices...	2½
IR5 Wage Administration.....	2½
IR6 Employment Testing.....	2½
IR7 Practical Training Methods.	2½
IR20 Labor-Mgmt. Relations.....	2½
IR21 Labor Leg., Un.-Mgmt. Rel..	2½
IR22 Lab. Leg., Stds. & Cond. Emp.	2½

Production

D40 Purchasing.....	2½
M2-3 Mathematics.....	4
IM2 Work Measurements I.....	2½
IM5 Work Simplification I.....	2½
IM7 Job Analysis and Evaluation	2½
IM8-9 Production Plng. & Control	4
IM10 Mats. of Prod.....	2½
IM11 Production Processes.....	2½
IM13 Industrial Safety.....	2½
L1-2-3-4 Legal Aspects of Bus. I-II...	8

Course No.	Semester Hours
Purchasing	
D5 Principles of Salesmanship...	2½
D30-31 Foreign Trade.....	5
D40 Purchasing.....	2½
Ec20-21 Management Statistics.....	4
IM10 Mats. of Prod.....	2½
IM11 Production Processes.....	2½
IM20 Quality Control.....	2½
L1-2-3-4 Legal Aspects of Business...	8

Real Estate

Ec3-4 Fin. Business Operations...	4
In4-5 Casualty Insurance.....	5
In6-7 Fire and Allied Lines.....	5
L1-2-3-4 Legal Aspects of Bus. I-II...	8
RE1 Real Estate Fundamentals...	2½
RE2 Real Estate Law & Convey.	2½
RE3 R.E. Investment & Mgmt...	2½
RE4 Real Estate Finance.....	2½
RE5 R.E. Selling and Advertising	2½
RE6 Operating a R.E. Business...	2½
RE7 R.E. Appraisal—Residential	2½
RE8 R.E. Appraisal—Commercial.	2½

Retailing

D1-2 Principles of Distribution...	4
D5 Principles of Salesmanship...	2½
D52 Consumer Credit.....	2½
IR2-3 Human Relations.....	5
IR7 Practical Training Methods.	2½
R1 Retail Store Management...	2½
R2 Retail Store Merchandising.	2½
R3 Retail Store Advertising...	2½
R4 Merchandise Display.....	2½

Sales

D1-2 Principles of Distribution...	4
D5 Principles of Salesmanship...	2½
D7 Sales Promotion.....	2½
D8 Sales Management.....	2½
D10 Market Research.....	2½
D20-21 Principles of Advertising...	5
D23 Advertising Copy.....	2½
D24 Advertising Production.....	2½
D25 Advertising Media.....	2½
D41 Consumer Packaging.....	2½
D50 Credit Fundamentals.....	2½
Ec20-21 Management Statistics.....	4
L1-2-3-4 Legal Aspects of Bus. I-II...	8

Transportation & Traffic Management

In4-5 Casualty Insurance.....	5
In8-9 Inland Marine Insurance...	5
L1-2-3-4 Legal Aspects of Bus. I-II...	8
T1 Transportation Practices...	2½
T2 Traffic Management.....	2½
T9-10 I.C.C. Prac. & Proced.....	5
T11 Motor Carrier Operations...	2½
T14-15 Rates and Tariffs.....	5

Course No.	Semester Hours	Course No.	Semester Hours		
Sales		Sales			
A30-31	Managerial Accounting	4	D7	Sales Promotion	2½
Ec1-2	Business Economics	4	D8	Sales Management	2½
Ec3-4	Financing Bus. Operations	4	D10	Market Research	2½
Ec5-6	Financial Policy & Planning	4	D20-21	Principles of Advertising	5
Ec20-21	Management Statistics	4	D40	Purchasing	2½
D1-2	Principles of Distribution	4	D41	Consumer Packaging	2½
D5	Principles of Salesmanship	2½		Elective	14

Courses other than those shown under the options may be taken upon approval of the Dean if they conform to the student's need. Special programs will be arranged to meet specific needs of students.

Advanced Secretarial Techniques

Women have demonstrated their value in business and industry by their effectiveness in handling administrative responsibilities. Today, more than ever, with the increased tempo of business activity and business complexity, they are being called upon to assume positions of increasing importance. To meet these growing needs for women qualified by training, the course Advanced Secretarial Techniques is offered.

While this course is particularly designed as preparation for taking the Certified Professional Secretary's Examination, the subject matter will prove of great value to all secretaries whose future will be in the administrative secretarial field.

The course is divided into four sections. Students may enroll for the program by section or in total. The four sections are: Accounting; Human Relations and Personal Adjustment; Business Law; Business Organization and Economics.

Residential Seminars for Administrative Secretaries

The forces that are shaping the future will bring to management an accelerated pattern of new and complex problems. The Professional Secretary, like every member of the management team, will be called upon to share a larger part of the administrative load. Opportunities will reward ability and preparation.

The Residential Seminars are of three types — the first which is orientational and exploratory in nature, the second which carries into more advanced management concepts and practices, and the third which, while continuing with certain applications to the work of an administrative secretary, is primarily concerned with personal development through the liberal arts.

The Residential Seminars are all conducted off-campus in suitably adapted educational environments.

University College

Special Programs

Designed to serve specific needs on a non-credit basis

Applied Security Analysis — Industrial Approach

University College in joint sponsorship with The Boston Security Analysts Society provides this advanced course in security analysis for men and women in the investment management profession or for others who may find such training of value in their work. It is designed to acquaint the student with methods used by practicing security analysts in their studies of various industries and to provide practical information useful in the investment analysis of companies operating in these industries.

The course includes: Basic principles of security analysis; the tools and methods used by practicing analysts; investment characteristics of the various industries and leading companies; sources of information and statistics; statement analysis; economic background; investment requirements and policies of different types of financial institutions.

The instructor will outline the problems, trends and investment characteristics of the industries under discussion and will demonstrate methods used in analyzing and following the securities of leading companies in these industries. Students will be required to prepare a written industry analysis under the guidance of a member of the Boston Security Analysts Society.

Environment and Environmental Testing

This course, offered co-operatively with the Institute of Environmental Sciences, represents an informative, "up-dating" series of lectures on the latest advancements in this rapidly developing field — taught by national authorities — for engineers and scientists concerned with the reliability of performance of equipment under severe environmental conditions.

This comprehensive survey includes: High and low temperature environments; weather environment and testing; modifying environmental conditions by use of shock and vibrations isolators; designing for shock and vibration; instrumentation for dynamic measurements; shock tests and shock spectra; random vibration; sand, dust, fungus and corrosion resistance; radiation effects on components' outer space environment; and acoustic noise.

Fundamentals of Purchasing

This course, offered co-operatively with the New England Purchasing Agents Association, is designed to serve those currently employed as buyers, assistant purchasing agents or those newly advanced to the responsibilities of the purchasing agent. The course is practical and deals with the problems encountered in the everyday business operations.

The instruction includes: Organization of the purchasing department; problems of vendor relationships; purchasing procedures; inventory control policies and methods; cost reduction through value analysis and standardization; savings through knowledge of traffic classifications and routings; use of substitute materials; standards and specifications; reports and budget information for management; purchase of capital equipment; legal status of purchasing; market analysis.

Glass, Metal and Vacuum Processes

This course is especially designed for production supervisors and technicians who are employed by companies whose manufacturing process involves the formation of glass-to-metal seals and vacuum tight envelopes.

The instruction includes: General requirements for glasses and metals used in vacuum seals; soft glass seals; hard glass seals; special seals; chemical properties of glass as related to weathering devitrification, and other sealing characteristics; properties of metals used within the vacuum envelope; vacuum systems; and vacuum pumps.

Motor Vehicle Fleet Supervisors' Course

This standard course, conducted annually by University College in co-operation with the Institute of Public Safety, Pennsylvania State University, is offered nation wide under the sponsorship of the National Committee of Motor Vehicle Supervisors' Training. It is designed for fleet supervisors, safety personnel and training directors. It presents a practical program of supervisory training leading to the reduction in the frequency and severity of accidents, the lowering of maintenance costs, improvements in efficiency of operation through better supervision and employer-employee relationships, and the enhancement of public relations.

Particular attention is given to methods of selecting, training and supervising drivers. This program is so scheduled as to give each student the maximum opportunity to participate individually in each of the laboratory and field test exercises.

Motor Vehicle Fleet Maintenance Supervisors' Course

This course will present in practical form the principles and application of Preventive Maintenance to motor truck, bus, and taxi fleets. It is designed for fleet maintenance superintendents, shop foremen, inspectors and maintenance engineers for insurance companies, training directors and executives related to the problems of effective fleet operation.

It presents a practical program of instruction leading to higher dependability and performance from the equipment at the lowest possible cost consistent with sound operating practices.

Quality Control For Inspection and Production Supervision

This course is designed to meet the increasing need of inspection and production supervision for a one-semester summary of the more important routine quality control techniques. It presents the most modern inspection practices and the latest methods of reducing costs associated with defects. A non-mathematical approach is used, and no prerequisite courses are necessary. Major emphasis is placed on sampling acceptance plans and preventing defects during production.

Instruction includes: The theory of sampling; military standard 105-A; acceptance sampling; prevention of defects; process control; control charts and their use; cost of defects; reporting methods; and organization for quality control.

Rubber Technology I

Sponsored co-operatively with The Boston Rubber Group, this course outlines a basic and practical study of the compounding and processing of natural and synthetic rubbers. Common compounding ingredients, various elastomers as well as basic processing techniques and equipment are discussed. Some attention is centered upon test methods, quality control, etc. The course is designed for beginning compounders, salesmen, purchasing agents, production supervisors, specification writers, university students and all those interested in broadening their knowledge of the Rubber Industry.

Rubber Technology II

The course is designed to supplement the Rubber Technology I course, and to provide an introduction of the principles and practices of rubber compounding which reflects the latest theoretical concepts. The relationship of polymer structure to properties, and how these structural characteristics can be used to advantage by the rubber compounder, will be covered.

Five major problems in areas of rubber manufacture such as rubber footwear, wire and cable and molded products will be presented by guest lecturers. The course will be technical in content, and as a prerequisite applicants should have either completed the Rubber Technology I course or have a B.S. in Chemistry.

X-Ray Technology Course

The New England Roentgen Ray Society and the Massachusetts X-Ray Technicians join with University College to provide this special program of training for young men and women employed in the hospitals whose X-ray training programs have been approved by the American Medical Association. All students must be recommended by the Chief Radiologist as qualified for admission to the course. In addition to providing basic training for effective practice, the course also provides preparation for those planning to take the National Examination to become Registered X-Ray Technicians.

The course covers the following areas: Nursing procedures; positioning; anatomy; dark-room techniques; special procedures; physics; X-ray techniques; X-ray therapy; isotopes; office procedures.

Workshop in the Management of Small Business

The Workshop is an advanced level course restricted in enrollment to twenty-five (25) owner-manager representatives of small business. To attain the homogeneity necessary for free and worthwhile participation in discussion of a practical nature, separate workshops are offered for manufacturers, distributors, wholesalers, jobbers, factory representatives, etc. — and a third for retailers, again by classification.

It recognizes the uniqueness in the types of problems encountered in day-to-day involvement of the small businessman, and uses the discussion approach which does not try to translate big business into small business situations, but rather accepts the problems of small business in the context of its own operational environments.

The Workshop is concerned with the 4 M's of Management: Manufacturing—Marketing or Merchandising — Money — Men.

University College

Description of Courses

THE UNIVERSITY reserves the right to withdraw, modify or add to the courses offered, or to change the order of courses in curricula as may seem advisable.

The University further reserves the right to withdraw in any year any elective or special course for which less than twelve enrollments have been received. Regular students so affected by such withdrawal will be permitted to choose some other course. In the case of special students, a full refund of all tuition and other fees will be made.

The University also reserves the right to change the requirements for graduation, tuition and fees charged, and other regulations. However, no change in tuition and fees at any time shall become effective until the school year following that in which it is announced.

All full-year courses are numbered with a double consecutive number and all half-year courses with a single number. The letter or letters immediately preceding the numbers indicate the classification of the course. The prerequisites for any course are indicated and enrollment in any course is predicated on having met or completed the requirements stated.

Credit for a full-year course is contingent upon satisfactory completion of both semesters.

Credit for one-half of a full-year course is given only upon approval by the Dean.

ACCOUNTING (A)

Applicants for admission to the College who have had experience in accounting or bookkeeping or who have pursued systematic courses in institutions of less than college grade may take an examination for placement purposes in Introductory Accounting. Those who pass this examination will be admitted to Intermediate Accounting and may substitute an elective course in lieu of Introductory Accounting.

A 1-2 INTRODUCTORY ACCOUNTING

This course provides basic instruction for those who plan to specialize in accounting or for those who wish to enroll later for more advanced courses. Emphasis is placed upon proprietorship accounts, including books of entry, statements, business practices, adjustments and an introduction to partnership accounts. Drill and practice work are required for proficient handling of simple accounting transactions.

(No previous knowledge of bookkeeping or accounting necessary)

4 semester hours credit

CORE COURSE for students in Accounting Curricula

A 3-4 INTERMEDIATE ACCOUNTING

A continuation of Introductory Accounting, treating with problems of the partnership and corporate forms of business entities. Accounts for a manufacturing business are introduced. In addition to the drill and practice work on accounting technique, a mastery of many accounting principles is required.

(Prerequisite, A 1-2)

4 semester hours credit

A 5-6 ACCOUNTING PROBLEMS

This course is designed to develop the student's reasoning power and his ability to apply the proper accounting principles in solving a specific problem. Emphasis is placed on principles and their application rather than on individual situations. Subjects covered are the preparation of financial statements, accounting for and valuation of cash items, receivables, inventories, liabilities and net worth accounts. Capital stock, treasury stock and surplus are discussed in detail.

(Prerequisite, A 3-4)

5 semester hours credit

A 7-8 ADVANCED ACCOUNTING PROBLEMS

This course is designed primarily to meet the requirements of students intending to enter the accounting profession. Application of accounting principles to special situations such as partnerships, insolvent companies, estates and trusts, installment sales and consignments. Considerable time is spent on preparation of consolidated statements.

(Prerequisite, A 5-6)

5 semester hours credit

A 9-10 C.P.A. PROBLEMS

A complete review of the theories encountered in A 5, 6, 7, 8, 14, 15, 50, 51. This course is primarily for students intending to take the state C.P.A. examinations. Considerable practice is required, using largely problems from previous C.P.A. examinations. Emphasis is placed on the technique of adequate problem solutions. One feature of the course is a series of three-hour practice C.P.A. examinations held every third week throughout the course.

(Prerequisites, A 7-8; 11; 14-15; 18-19; 50-51; L 4)

10 semester hours credit

A 11 FUND ACCOUNTING

The concept of "fund" accounting finds its application in the accounting procedures of governmental units, charities, and educational institutions. This course deals with segregation of assets and liabilities into funds and self-balancing groups required by the organization of non-profit enterprises.

Integrated into the principles of funds is the treatment of accounting controls necessitated by governmental approaches or budgets.

(Prerequisite, A 5-6)

2½ semester hours credit

A 12 CONSTRUCTIVE ACCOUNTING

To acquaint students with the principles underlying the construction of accounting systems and the procedure of system installation. The course is developed by means of problem projects beginning with an analysis of the accounting needs of a small business. By gradual steps increasingly larger businesses are studied and accounting systems developed to meet their needs. Special attention is given accounting records in relation to the expansion of the accounting system.

(Prerequisite, A 5-6)

2½ semester hours credit

A 13 MATHEMATICS OF ACCOUNTING

Mathematical computations required in business practice and in C.P.A. examinations are covered. Considerable practice material is assigned to develop facility and accuracy in mathematics.

Arithmetical computations: Percentages, averages, interest, discounts, partial payments, installment sales, valuation of good will, logarithms, depreciation, gross profit.

Algebraic computations: Tax and bonus problems, determination of net worth of inter-owned companies.

Actuarial science: Compound interest, compound amounts and present values; ordinary annuities and annuities due; sinking fund computations; debt amortizations; effective interest on bonds.

(Prerequisite, A 5-6)

2½ semester hours credit

A 14-15 COST ACCOUNTING

Acquaints the student with the relationship of cost accounting to management and administration control and shows how adequate cost systems may further the intelligent management of business enterprises. Job order, process, and standard cost systems and their integration into the general accounting system of the business are studied. Numerous problems and sets serve as the basis for a study of the various accounts, records, systems, and methods commonly used in modern cost accounting.

(Prerequisite, A 5-6)

5 semester hours credit

A 16-17 ADVANCED COST ACCOUNTING

Intended only for the student who desires to enter the field of cost accounting, this course presents advanced situations and the more intricate problems encountered in cost accounting for specialized businesses. Included in the course is a thorough study of distribution and administrative costs. Each topic is approached from the point of view of what management may expect and the use to which cost information may be put.

(Prerequisite, A 14-15)

5 semester hours credit

A 18-19 AUDITING

This course is offered primarily for students who intend to enter Public Accounting. It covers both theory and practice of auditing with emphasis on statement presentation and internal control. Procedures employed in balance sheet audits in verifying cash, receivables, inventories, investments, plant assets, intangibles, deferred charges, liabilities, capital, income and expense accounts are covered.

Attention is given to pronouncements, research bulletins and statements on auditing procedure issued by the American Institute of Certified Public Accountants. Co-ordinated with the study of auditing principles and procedures is a practice audit simulating the work of public accountants and the entire work of the course is summarized in an audit report prepared toward the end of the course.

(Prerequisite, A 5-6) (Required of Public Accounting students only)

5 semester hours credit

A 20-21 INTERNAL AUDITING

This course covers both basic auditing theory and a study of the function of the internal audit as an independent appraisal activity within an organization for the review of accounting, financial and other operations as a basis for service to management. All balance sheet items are reviewed as to audit verification procedures and internal control standards. In addition, audit of non-accounting functions such as sales, billing, purchases and inventory control are covered. Statistical sampling, audit working papers, written audit reports and other tools of the internal auditor are studied. Case problems in internal auditing and control are discussed in class. Attention is given to statements and bulletins issued by The American Institute of Certified Public Accountants and the Institute of Internal Auditors. Accounting theory is discussed where necessary to clarify auditing procedures.

(Prerequisite, A 5-6) (Required of Commercial and Cost Accounting students)

5 semester hours credit

A 30-31 MANAGERIAL ACCOUNTING

A study of the broad background of accounting and business transactions as a basis for preparing the student to analyze and interpret intelligently financial statements and other accounting reports. Topics covered are the development of accounting fundamentals, accounts for the proprietorship, partnership, and corporate forms of business organization, and preparation of financial statements.

4 semester hours credit

CORE COURSE for students in Non-Accounting Curricula

A 32 FINANCIAL AND ADMINISTRATIVE ACCOUNTING

This is a management approach (for non-accounting majors) to various aspects of control exercised through budgetary procedures, the analysis and interpretation of financial statements, and other accounting reports as they relate to operation and the formulation of business policies.

(Prerequisite, A 30-31)

2½ semester hours credit

A 33 MANAGERIAL COST CONTROLS

Increasing emphasis on the cost factors of production and distribution necessitates a fundamental knowledge of cost procedures on the part of every student training for management responsibilities. This course is designed to provide a practical coverage of basic cost procedures related to materials, labor and manufacturing expense control, and their integration with general manufacturing accounts.

(Prerequisite, A 30-31)

2½ semester hours credit

A 34 ANALYSIS OF FINANCIAL STATEMENTS

This course embodies a study of the techniques used by management, creditors, investors and regulatory authorities in the analysis and interpretation of financial statements for the purpose of establishing credit ratings, determining the investment value of a business, testing the efficiency of operations, and determining whether financial and operating policies, methods, and practices should be continued or changed. The student's ability to analyze, question, determine significant omissions, to criticize constructively, and to distinguish between inferences and facts is developed by extensive use of published corporate reports. The companies selected for study are in industries important to the New England economy such as transportation, power, fuels, lumber, merchandising, textiles, electronics, machinery, paper, shoes, etc.

(Prerequisites, A 5-6 or 30-31, 32)

2½ semester hours credit

A 35-36 CONTROLLERSHIP

Most of the first semester of this course is devoted to the budgeting activities of the controller. Procedures and techniques used in preparing a comprehensive budget are discussed and illustrated by the compilation of a master budget plan from sales, production, manufacturing, selling and administrative expenses through the balance sheet and profit and loss statement. A comparison of the budget and actual financial statements is prepared.

Following this, the course covers the functions and organization of the controller's department, basic techniques employed by the controller, the interpretation of historical results and their co-ordination into the broad policy-making program of the business. The technical phases of the controller's work are covered as preparation for the study of his role as reporter, adviser, and counsellor to business management at all executive levels.

(Prerequisites, A 5-6 or 30-31, 32)

5 semester hours credit

A 37 PUNCH CARD ACCOUNTING

Designed to give accountants, methods men, and executives a working knowledge of punch card accounting, this course offers a comprehensive coverage of available equipment and of installation and operational techniques. Included are working demonstrations of International Business Machines, Remington-Rand, and Underwood-Samas machines; discussion of basic machine functions and methods designed to produce economical and efficient use of such equipment. The subjects covered include card and forms design; preparation of operating manuals; accounting room layout and work scheduling; a detailed presentation of payroll application, inventory and material, commodity billing, accounts payable, accounts receivable, plant and equipment, and bank deposit accounting.

(Prerequisite, A 3-4 or 30-31)

2½ semester hours credit

A 50-51 BASIC FEDERAL TAXES

An introductory study of the Federal Income Tax Law and its application to the income of individuals, partnerships, and corporations, including filing requirements; taxable income, allowable deduction, gains and losses on sales or exchanges; dividends and stock rights; net operating losses; types and preparation of returns.

(Prerequisite, A 3-4 or 30-31)

5 semester hours credit

A 52-53 ADVANCED FEDERAL TAXES

This course involves a detailed study and analysis of leading court cases. It will help the student to obtain a knowledge and understanding of court and treasury reasoning which define and interpret the Internal Revenue Code and its regulations. The history and development of changes affecting important principles and phases of taxation are discussed, replete with illustrations and examples. The objective is to enable the student independently to apply the principles and theory learned to problems arising in his own business or personal practice.

(Prerequisite, A 50-51)

5 semester hours credit

DISTRIBUTION AND MARKETING (D)

Marketing enters into and influences every field of business and includes not only the direct process of the sale of goods, but the whole organization by which goods find their way from the original producer to the ultimate consumer. The change in the economic structure during the past ten years, growing out of higher standards of living, the development of new occupational interests and the shift of population to large cities, has tended to increase the cost of marketing of goods. Just as the elimination of waste in production was the keynote of business fifteen years ago, the reduction of expense and the introduction of more efficient methods in distribution are the foremost thought of business leaders today. For this reason courses in marketing form one of the basic elements in a business education.

D 1-2 PRINCIPLES OF DISTRIBUTION

This course is designed to study the field of distribution as one of the major elements in the management of any business. Broad in scope, through the management approach it is concerned with the economic and sociological aspects of marketing a product or service from the producer to the ultimate consumer, exploring all of the interrelated factors and management tools involved in the various channels and processes.

CORE COURSE (Prerequisite Ec 1-2)

4 semester hours credit

D 5 PRINCIPLES OF SALESMANSHIP

The one all-important aspect of successful salesmanship — an understanding of people, without which any sales technique becomes routine and ineffective. Based upon what makes people behave like human beings, it analyzes the basic needs, desires, tastes, habits that motivate them into buying; their individual differences — the secret to the art of selling (finding that all-important point of contact); the art of allowing people to sell themselves; factors which turn refusals into sales. A course for the veteran or the beginner.

2½ semester hours credit

D 6 TECHNIQUES OF SALESMANSHIP

A techniques course operated on the laboratory-lecture method in which psychological principles are applied to the basic aspects of selling.

The student learns through visual aids, role-playing techniques, student demonstrations using modern effective equipment and techniques, guest lecturers, etc., the proper methods of approach, how to arouse the buying urge, the common obstacles met in selling, the meeting of sales resistance, the closing of the sale, etc.

The class is limited in size to guarantee adequate participation by each student.

(Prerequisite, D 5)

2½ semester hours credit

D 7 SALES PROMOTION

The function of sales promotion; the development of plans and materials for stimulating sales; the consideration of publicity media; the preparation of direct advertising pieces for use among the sales force of the manufacturer or wholesale distributor; functions and uses of direct advertising, direct-mail advertising and radio advertising; the planning of sales campaigns; co-ordinating advertising and sales efforts; the preparation of sales manuals, display techniques, portfolios, etc., for use of the sales force.

(Prerequisites, D 1-2, 20-21)

2½ semester hours credit

D 8 SALES MANAGEMENT

This course is devoted to the function of the sales manager in terms of his relationship to the marketing process, involving the aspects of planning, investigation of the market, pricing the product, planning the sales effort, management and control of the sales personnel and sales operations. It includes in detail a study of the types of sales organizations, sales policy, sales campaigns, financing of sales, and the selection, training, and supervision of the sales force.

(Prerequisite, D 5)

2½ semester hours credit

D 9 SALES EXECUTIVE TRAINING

Successful sales managers do not "just happen" — they must be trained. There is no guarantee that the "star salesman" will become a successful sales manager. Every company's future is dependent upon a succession of capable men trained to manage its sales.

This purely practical course, placing special emphasis upon the sales personnel, is designed for sales managers or company sponsored salesmen who have demonstrated management potentialities; considers on an advanced level the comprehensive function of the sales manager — his varied responsibilities; the importance of setting goals; selection and training of salesmen; turnover; the high cost of sales: follow-up, records, and periodic appraisal; the function of leadership; delegation of responsibilities; motivation to procure maximum sales production.

(Prerequisite, D 6)

2½ semester hours credit

D 10 MARKET RESEARCH

This course deals with the techniques of research investigations in the collection and utilization of data relating to the problems of marketing. It includes the planning of mail and field investigations, preparation of material, testing results, interpretation of findings, preparation of reports leading to the development of new products, sales methods or sales areas.

(Prerequisites, D 1-2, Ec 20-21)

2½ semester hours credit

D 11 MARKETING MANAGEMENT SEMINAR

This course uses the framework of a dynamic economy so that the marketing operation is integrated into its economic environment. It attempts to incorporate recent developments in the behavioral sciences such as applied economic theory, social psychology and operations research.

The course concerns itself with marketing alternatives such as product variation, marketing channels, price, advertising, personal selling and the location of the company's operations. In deciding which particular combination of these alternatives to use in order to solve a given marketing problem, the student is forced to consider the following: competition, demand, cost, the structure of distribution and the law.

Once the typical considerations pertinent to these problems are analyzed, the student uses qualitative rules and guides or quantitative measurements of contribution to profit, in choosing the best marketing strategy. Certain patterns of behavior based on experience and observation aid in eliminating unfeasible strategies. After estimating the effect of the feasible strategies on company profit, and with the aid of market research techniques to collect information as the basis for a rational decision, strategy is chosen that will yield the maximum contribution to company profits.

2½ semester hours credit

(An advanced level course with enrollment only by approval of the Dean)

D 20-21 PRINCIPLES OF ADVERTISING

A comprehensive course designed to familiarize the student with the nature and scope of advertising and its place in the commercial and economic structure. History, definition and functions of advertising. Organization and functions of advertising departments and advertising agencies. Varieties of advertising and media. Problems, market investigation, planning campaigns. Laws, ethics, and regulations. A study of the broader aspects of advertising with special emphasis on current trends and developments.

5 semester hours credit

D 22 ADVERTISING PROBLEMS

This course, conducted on a seminar basis, is designed to analyze the sales conditions and to find the advertising objectives of specific case subjects. It brings into use knowledge previously gained in the planning of an advertising campaign, the solving of advertising objectives and the development of advertising strategy, using the most adequate and effective media. The course is in effect a workshop in which each student personally develops his own advertising project.

2½ semester hours credit

(Prerequisite, D 20-21)

D 23 ADVERTISING COPY

A course designed to furnish essential groundwork for successful copy writing. Includes study of market-analysis, product and consumer research; class discussion of and participation in comparisons of media and methods, from the standpoint of the copy writer; drill and practice in writing specific industrial, general, retail, radio and mail-order advertising copy; development of techniques, vocabulary and facility.

(Prerequisite, D 20-21)

2½ semester hours credit

D 24 ADVERTISING PRODUCTION

The methods and techniques of advertising production, including layouts; use of illustrations; the development of typography; types and type selection; composition; engraving processes; the several printing processes, including letterpress, lithography, and gravure; specifications and estimates.

(Prerequisite, D 20-21)

2½ semester hours credit

D 25 ADVERTISING MEDIA

This course is intended to prepare the student of advertising for the intelligent choice of advertising media requisite to adequate and economical market approach and coverage. It includes practical analysis of consumer, trade and professional magazines, newspapers and other publications, direct-mail, radio and television, outdoor advertising; fundamental product research to establish criteria for advertising media selection; a study of relative values of media from the standpoint of merchandising from manufacturer, through retailers, to the consumer.

(Prerequisite, D 20-21)

2½ semester hours credit

D 26 DIRECT-MAIL ADVERTISING

A practical presentation of principles and procedures in mail-selling campaigns, including the aspects of list building; writing effective sales letters, circulars, and catalogs; copy testing; analysis of selected direct-mail campaigns; printing and production methods and costs; postal rates and regulations; and intervals of mailing, etc.

(Prerequisite, D 20-21)

2½ semester hours credit

D 30-31 FOREIGN TRADE

The course is designed to introduce the student to world trade, its development and current status, the economic and political developments which affect the volume and direction of the flow of goods. Subjects discussed are the balance of international payments; trade agreements; tariff and non-tariff control measures and policies; export and import departments; middlemen; foreign agents and distributors; branch houses; handling import and export traffic; study and choice of markets; settlement of trade disputes; international banking facilities, foreign credits; foreign exchange; foreign investments and foreign exchange. The execution of foreign trade documents will be carried out throughout the course.

(Prerequisite, Ec 1-2)

5 semester hours credit

D 40 PURCHASING

A practical study of the functions and duties of the purchasing agent, the organization and administration of his department, and his relations with other departments. The following are representative of subjects discussed: the purchasing function, qualifications and responsibilities of the purchasing officer; purchasing organization and procedure; quality determination, inspection and inventory control; source selection and procurement by manufacture; price policies, forward buying and procurement budgets.

2½ semester hours credit

D 41 CONSUMER PACKAGING

This course is designed to cover the many problems to be reckoned with in creating a package to meet the high competition of current marketing trends with particular emphasis on color, part layout, and design for adaptability to automatic packaging equipment. It involves all of the basic package materials and forms, and includes such important topics as "The Evolution of the American Market," "Market and Consumer Research" and "Legal Protection." The course is further highlighted with lectures presented by experts from the packaging field.

(Prerequisite, D 20-21)

2½ semester hours credit

D 42 INDUSTRIAL PACKAGING AND PACKING

The science of packaging and packing for protection during shipment has experienced rapid advance. This course is devoted to current practices of industry as well as specifications applied to government contracts. Considered in this course are the basic types of containers; inner packaging; container design and utilization; dynamics of cushioning; government packaging, packing, and marking; testing of materials and containers; consumer packing-machinery and equipment; packing, loading, and shipping heavy apparatus; specifications for materials and containers.

(Prerequisite, IM 40-41)

2½ semester hours credit

D 50 CREDIT FUNDAMENTALS

This course furnishes instruction in the organization and functions of the commercial credit department; the classification of credit and the several types of agencies involved; the factors involved in a credit risk; the investigation of credit factors; credit services.

(Prerequisite, A 3-4 or 30-31)

2½ semester hours credit

D 51 CREDIT PROBLEMS

This course continues into the more detailed problems of the credit manager in determining credit disposition. The following subjects are included: ratio analysis of financial statements, statement analysis by comparison, collection problems and procedures, insolvency in its various forms, creditors' legal aids, credit insurance and guaranties, the general problems of the credit manager in administering his function of the business organization, activities of the National Association of Credit Men.

(Prerequisite, D 50)

2½ semester hours credit

D 52 CONSUMER CREDIT

This course covers all phases of credit extended to consumers—retail stores; bank personal loans; consumer financing by banks; real estate financing; bank charge account plans; small loan companies; sales finance companies; utility companies; credit investigation and evaluation; collection procedures; Credit Bureau operations; legal aspects of credit.

(Prerequisite, D 50)

2½ semester hours credit

ECONOMICS (Ec)

Economics is the basic foundation upon which the general principles of business as a science are founded. A mastery of the underlying economic laws enables the student to see clearly the forces which business men must use in arriving at solutions to their problems. An appreciation and understanding of economics is a necessary factor in the equipment of a progressive business man.

Ec 1-2 BUSINESS ECONOMICS

The study of our economic society, its institutions and their practices as essential prerequisites to the successful conduct of business affairs and to the development of intelligent citizenship. The introductory course aims to provide the significant economic principles and facts about industry, labor, money, banking, the distribution of income to the factors of production, business fluctuations, and forms of social organization. Consideration is given to current economic problems, in relation to the basic principles and laws, and to their implications for individuals, business, and government, as well as society at large.

CORE COURSE

4 semester hours credit

Ec 3-4 FINANCING BUSINESS OPERATIONS

The needs for capital in the production and merchandising of goods and services; the sources of long-term and short-term funds and their utilization form the basis for the introduction to finance as a basic function of business management. Credit instruments, trade credit, secured and unsecured loans, specialized forms of short-term financing and consumer credit are considered in the first semester. Money, the commercial banking structure, the Federal Reserve System, thrift institutions and other financial agencies and services as they relate to operations of the business firm form the basis of the second semester, which concludes with brief consideration of both international and public finance.

CORE COURSE (Prerequisites, Ec 1-2; A 1-2; 3-4 or 30-31)

4 semester hours credit

Ec 5-6 FINANCIAL POLICY AND PLANNING

This course includes a study of the corporate form of organization, the various types of securities utilized, and the financial problems involved in promotion and expansion of enterprises, in mergers, in sale of properties, and in failures and reorganizations. Attention is devoted to the planning aspects of the corporation financial officer's job with respect to budgets, operating reports and their analysis. Policy matters such as executive compensation, dividend policies, pensions and profit-sharing plans are also dealt with.

CORE COURSE (Prerequisite, Ec 3-4)

4 semester hours credit

Ec 7 INVESTMENT PRINCIPLES

The characteristics of the entire range of securities from government bonds to common stocks form the foundation of this course as they relate to various types of investment programs. Sources of information, mathematics and mechanics of investment and the differing analytical approach to various industries are considered primarily from the viewpoint of the individual private investor interested in practical methods of capital preservation.

(Prerequisite, Ec 5-6)

2½ semester hours credit

Ec 8-9 APPLIED SECURITY ANALYSIS

This course is designed to acquaint the student with methods used by practicing security analysts in their studies of various industries and to provide practical information useful in future analysis of companies operating in these industries. It includes review of basic principles of Security Analysis; tools used by practicing analysts; analytical study of various industries comprising our economy, including the major consumer goods, capital goods, service industries, public utilities and railroads. Practicing analysts who are specialists in their respective industries will comprise the faculty. These instructors will develop the problems affecting their industries, the methods used in appraising their outlook, and the approaches to the problems of analyzing the securities of individual companies within these industries. A term paper is required of each student, during the preparation and writing of which he is assigned to a practicing analyst for technical assistance.

(Prerequisites, A 34, Ec 7 or equivalent)

5 semester hours credit

Ec 10 MANAGEMENT OF PERSONAL FINANCE

The purpose of this course is to give help to young men and women with the financial problems they face in charting wise programs of handling their personal finances. It is introduced by a discussion of money, its function, dollar value, and an appreciation of true values in life, using money to achieve the same. The course continues with a consideration of the following: expense control through budgeting; wise buying methods and policies — charge accounts, installment buying; financial institutions for borrowing money; protection against risk to person and property; methods of saving; the place of life insurance in financial planning; owning a home; investing in securities; trust funds, investment trusts; making a will; business fluctuations and the planning of personal finances.

2½ semester hours credit

Ec 11 ECONOMIC GEOGRAPHY

This course is concerned with the role of geography, geology, and climatology in determining the centers of population, the location of natural resources, and the development of agriculture and industry. It considers their location in terms of their natural relationship to the flow of world trade. The socio-economic principles that underlie the development of resources in different countries and climates are emphasized. It also analyzes the political-economic aspects of resource distribution and development in the form of trade and world relationship.

2½ semester hours credit

Ec 12 GOVERNMENT CONTROLS IN BUSINESS

A study of the economic and political relationships which exist between business and government with particular reference to the Sherman Act and Anti-Trust Laws; Securities and Exchange Commission; Interstate Commerce Commission; regulation of public utilities; the Co-operative Movement; the Social Security Act; government and labor; business regulation by taxation.

(Prerequisite, Ec 1-2)

2½ semester hours credit

Ec 20 MANAGEMENT STATISTICS

The objective of this course is to introduce the student to statistical techniques and their application to the analysis of problems in business and industry. It presents the fundamental concepts underlying analytical methods and serves as a preparation for advanced courses in statistics and quality control.

It is primarily concerned with descriptive measures of shape, location, and dispersion, an introduction to basic probability, sampling and simple analysis of observed distributions. The student also gains practice in tabular and graphic presentation. A part of each session is devoted to laboratory practice and solution of problems.

CORE COURSE *(Prerequisite: M 2-3)*

2 semester hours credit

Ec 21 MANAGEMENT STATISTICS — BUSINESS APPLICATIONS

This course is required for all students not enrolled in the Production or Industrial Management curricula. The course is concerned with the testing of simple hypotheses, use of confidence intervals, and the application to business problems of sampling distributions, particularly the normal, binomial, Poisson, *t*, and Chi-square distributions. Problems drawn from business situations also illustrate the application of the analysis of variance and correlation techniques.

(Prerequisite, Ec 20)

2 semester hours credit

CORE COURSE *for all except Production and Industrial Management students*

Ec 23 STATISTICAL METHODS IN FORECASTING

This course introduces the student to the application of time series and analysis. Among the principal topics considered are the measurements of secular trends by free hand and mathematical methods; the measurement of seasonal fluctuations; cyclical fluctuations; the general nature and calculation of index numbers; and a discussion of regression and correlation.

(Prerequisite, Ec 21)

2 semester hours credit

Ec 30 INTERNATIONAL ECONOMICS

This course analyzes foreign trade and finance in terms of current practices and theories. It discusses national welfare and foreign trade; international accounting and what the balance reveals; the making of international payments and documents used; the rate of exchange, international equilibrium; foreign trade and the national income; principles behind protection; trade control through the tariff, import quotas, exchange control and their evaluation; international commodity agreements and commercial treaties; monetary policy problems; the international gold standard; exchange reserve standards; exchange stabilization fund; the shortage of dollars; the International Monetary Fund; international investments.

(Prerequisite, Ec 1-2)

2½ semester hours credit

Ec 31 MANAGERIAL ECONOMICS

The purpose of this course is to show how economic analysis can be used in formulating business policies. It is an attempt to bridge the gap between the logic of economic theory and the problems of policy for practical management. The course stems from the conviction that the economic theory of the firm should be the core of work in business administration and that the procedures and methods of such specialized areas as marketing, production, and accounting should be related to the broad profit-making objective of business enterprise. In developing an economic approach to executive decisions, the course draws upon economic analysis for the concepts of demand, cost, profit, competition, etc., that are appropriate for the decision. Modern methods of econometrics and market research are employed to the extent and to the degree that they are necessary for getting estimates of the relevant concept.

(Prerequisites, Ec 1-2, 20-21)

2½ semester hours credit

Ec 32 MONETARY POLICY

The Federal Reserve System is charged with regulating the amount of money in our economy. Their policies vitally affect the business community. An understanding of Federal Reserve and Treasury policies and action is essential to an understanding of our economic system. The primary purpose of the course is to integrate the student's knowledge about the causes of inflation and deflation. Discussion centers on the nature of money and credit and their influence on interest rates, prices and the level of our economy. Monetary theories are studied to the extent time permits.

(Prerequisite, Ec 5-6)

2½ semester hours credit

Ec 34-35 BUSINESS PLANNING AND RESEARCH

To assist business men to make more definite and more accurate business decisions through a broader understanding of the significant information and statistics regarding our economic system and its operations is the major objective of this course. Sources of information, strengths and weaknesses of principal measures of business activity and the use of several widely accepted indexes in general business forecasting are a major part of the study, as well as sales forecasting, business cycle analysis and the effects of the broadening relation of government policies upon the individual business firm.

(Prerequisites, Ec 5-6, 20-21)

5 semester hours credit

ENGLISH (E)

The value that comes from the effective use of good English in business reports and communications is being increasingly emphasized by business leaders. All students who are candidates for the degree or certificate are required to pursue systematic courses in English. Those having outstanding deficiencies may be required to take additional courses in English.

E 1-2 ENGLISH AND BUSINESS COMMUNICATIONS

This course is designed to provide instruction in the basic skills of communication so essential in the proper conduct of business. In addition to a practical view of the principles of grammar and punctuation, the course provides for frequent drill and discussion of word usage, sentence and paragraph construction, techniques of outlining and summarizing, and vocabulary building. Writing assignments are given in exposition and argumentation to develop adequacy for good usage and expression. In the second half of the year a study is made of currently accepted forms of business letters and interoffice communications. The course includes reading and discussion of contemporary essays. Entrance into this course is predicated on successful completion of the preparatory English diagnostic examination which will be administered the first meeting of this class.

CORE COURSE

4 semester hours credit

E 3-4 BUSINESS WRITING AND REPORTS

The course gives detailed attention to the problems in writing which call for accurate observing, technical descriptions, collecting of data, rewriting, analyzing problems, interpreting and evaluating information, defending judgments, drawing conclusions. Different types of reports, report format, and documentation are studied as well as library and business research techniques. The writing projects are varied and literary subjects are included as well as those which are business and professionally oriented. The course work has been planned to meet the demands for writing which are required of the trained man in business. Assignments in readings are taken from all conventional literary types to encourage an interest in the humanities and good reading.

CORE COURSE (Prerequisite, E 1-2)

4 semester hours credit

E 10 EFFECTIVE SPEAKING FOR BUSINESS

Those who wish to speak convincingly, to overcome self-consciousness, and to develop self-confidence will find this course meeting their needs. Students are trained in the selection and organization of speech materials, the delivery of the speech, and in other important essentials of effective speaking. The entire course is practical and not theoretical. Work is centered around the interests and topics of business men and is specifically adapted to their needs.

2½ semester hours credit

E 12 BUSINESS CONFERENCES

The management of modern business is conducted to a large extent through the use of conferences. *Increase in the technological aspects of our economy has accentuated the use of this management tool.* The objective of this course is to present techniques basic to group leadership. It provides instruction in the planning, participation, and leading of conferences. *Questioning techniques designed to stimulate, shape, and control group response are emphasized.* Classes are limited in size to allow regular and frequent participation by students. The conference topics are carefully designed so that the discussions are means of disseminating very worthwhile information regarding business management problems.

2½ semester hours credit

E 20 READING SKILLS

This course is devoted primarily to the development of correct reading techniques which lead to the ability to read faster with a higher degree of comprehension. Exercises for improving basic speed and comprehension include work with tachistoscope and films. Special attention is given to analytical reading and the improvement of study habits.

1¼ semester hours credit

E 21 VOCABULARY DEVELOPMENT

This course is designed to assist the student in developing an adequate vocabulary and in improving his ability to use this increased power of words for more effective presentation of ideas. It includes the important aspects in the development of the English language, how it has drawn from many other languages important roots, prefixes and suffixes, antonyms for variety and force of expression, etc.

1¼ semester hours credit

E 22 SPEED AND COMPREHENSION IN READING

The ability to read well is a skill of considerable value to students and to those in professional practice. Efficiency can generally be improved by analysis with subsequent substitution of good for bad reading habits. Special equipment for instruction and drill exercises are used to increase reading rate and comprehension. Methods to improve study habits and to develop an effective vocabulary are included.

2½ semester hours credit

E 23 CREATIVE THINKING

A development course primarily designed to teach the student to understand and apply his latent creativity to his vocational activities. Confidence and skill are developed by the student through directed practice in stimulating Creative Thinking exercises. Considerable attention is given to idea motivation, imagination development, experience analysis, and idea evaluation.

1¼ semester hours credit

E 24 ETHICS FOR MODERN BUSINESS

Man in his social evolution has passed through many stages of development. In contrast to the "privilege" of a few centuries ago, possession now carries with it responsibility. Modern management in an automated society must develop an increasing social consciousness and recognize the full implications of its decisions and actions. Against the background of the various systems of ethics, this course will critically analyze these implications in the changing climate in which modern business is conducted.

1¼ semester hours credit

INDUSTRIAL MANAGEMENT (IM)

With the complex and rapidly changing conditions of modern production, the functions of administration and management must be clearly defined and maximum economies effected. Through the problem approach, these courses train the student to supplant guesswork and trial and error processes with organized knowledge and proven management methods.

IM 2 WORK MEASUREMENTS I

This course is concerned with the fundamentals of time study and their use in setting production standards. The instruction includes history and background of time study; rating operator performance; mechanics of setting labor standards; construction and use of simple multi-variable charts; the value of predetermined time value systems and their variations; presenting time study data to management; the relation of time study to cost control and cost reduction; establishing standards for bench groups and conveyor lines; estimating from blueprints. Laboratory practice will supplement the classroom instruction.

2½ semester hours credit

IM 3 WORK MEASUREMENTS II

Review of stop-watch time study and performance ratings. Introduction to the use of element time studies for developing standard data. Incentives for indirect labor including supervisors, salesmen, etc. Procedure for handling involved time studies. Development of tables, families of curves, formulae, nomographs, and multi-variable charts for synthetic rate-setting purposes.

(Prerequisite, IM 2)

2½ semester hours credit

IM 4 SYNTHETIC TIME STANDARDS—M.T.M.

The development of time values for manufacturing operations using synthetic time standards is rapidly becoming widely established in industry, making it necessary for those in time study and its related fields to become acquainted with it. This course is designed to give the student a knowledge of the fundamentals of what is perhaps the most widely accepted system, methods-time measurement. This lecture and laboratory course discusses the basic motions and elemental time values, providing the student with an opportunity to develop time standards for actual operations encountered in manufacturing operations.

(Prerequisite, IM 2)

2½ semester hours credit

IM 5 WORK SIMPLIFICATION I

The course is designed to present the fundamental principles underlying motion analysis and work simplification. Included in the subjects considered are the following: Process and operation analysis through the use of process charts, flow diagrams, operation charts, man-and-machine charts, principles of motion economy. Workplace layout, labor-saving tools and equipment, laboratory development work. Practical applications of work simplification with particular emphasis upon cost analysis.

2½ semester hours credit

IM 6 WORK SIMPLIFICATION II

Short review of Work Simplification I; advanced study and laboratory practice in operations analysis and improvement; flow process, multiflow process, and multiple activity charts; work simplification as an aid to plant layout; camera analysis; work sampling or ratio delay study; integration of methods and time study; human relations in methods engineering.

(Prerequisite IM 5)

2½ semester hours credit

IM 7 JOB ANALYSIS AND EVALUATION

Basic principles underlying theory of wage calculation, job elements and their definitions, rating scales, writing job descriptions and specifications, selection of appropriate rating plan, setting up job factors and maximum point values, use of several methods of determining specific point values. Development of wage structures.

2½ semester hours credit

IM 8-9 PRODUCTION PLANNING AND CONTROL

A basic treatment of the planning principles applied to the development and operation of a manufacturing unit, including market and sales research; plant design and determination of required physical facilities; the internal organization; the engineering organization for development of product; production planning, including scheduling, dispatching, purchasing, receiving, stockkeeping; and measures of performance. This course accents the controls required for the orderly operation of the production department. The following subjects related to planning, scheduling, and control are included: basic organization, plant layout, flow, sales forecasts, budgeting, planning, routing methods, plant and departmental capacities, cost,

standardization, ordering, purchasing controls, receiving and storage, scheduling, materials handling, dispatching and subcontracting, machine loading, assembly, inspection, inventory control, measures of performance, co-ordination of sales and manufacturing, and introduction to mechanical means of control.

CORE COURSE

4 semester hours credit

IM 10 MATERIALS OF PRODUCTION

Fundamental to the study of production processes and the control of quality is a knowledge of the materials of production and the techniques of inspecting the accuracy of processing. This lecture and laboratory course first considers the study of materials, especially ferrous, non-ferrous, special alloy metals, plastics, etc., in terms of their basic characteristics, e.g., structure; hardness; strength in compression, tension, shear; workability; thermal, physical, electrical and chemical properties.

The course continues into the techniques and standard measuring equipment and gauges for mechanical inspection; discussion of tolerance limitations of machine tools and other processing equipment in common use.

(Prerequisite, IM 8-9)

2½ semester hours credit

IM 11 PRODUCTION PROCESSES

Basic to the study of production is a thorough understanding of the processes and shop production methods employed in the manufacture of products using various types of materials. Concentrated attention is applied to such processes as castings; hot-working, cold-forming, and joining of metals; machine shop production methods; plastics and plastic molding. The common production tools such as shears, presses, press brakes, lathes, boring mills, screw machines, milling machines, drills, shapers, slotters, planers, broaching machines, grinders, and saws are studied in detail including their uses, machine capacities, limitations, flexibilities, etc.

Working with actual products accompanied by production blueprints, the student determines the manufacturing processes required, selects the appropriate machines, equipment and tool setups. Under certain conditions alternate methods and equipment must be used. These are evaluated in terms of their practicality and economic advisability. Process sheets are prepared for all manufacturing operations involved for presentation to the production control department as a basis for scheduling and computation of machine loading charts.

(Prerequisite, IM 8-9)

2½ semester hours credit

IM 12 ESTIMATING FOR PRODUCTION

This course is designed to tie together and put to use the material contained in several prerequisite courses. It presents the systematic procedures followed in determining the estimated cost of manufacturing a product in a competitive market. Based upon certain known contractual data such as volume, materials and manufacturing specifications, the procedures include determination of quantities of raw materials necessary, their sizes, shapes, and physical characteristics; the analysis of the required processes and individual operations, machines and equipment necessary for fabrication; the determination and cost of tools required; the analysis of direct labor required for each operation; the burden or overhead chargeable against each department; and the total manufacturing cost including the sales and administrative expense.

Working with standard data and actual products with their accompanying manufacturing blueprints, the students will calculate practical and accurate estimates presented in accepted form.

(Prerequisites, A 30-31, IM 5, 11)

2½ semester hours credit

IM 13 INDUSTRIAL SAFETY — INDUSTRIAL ACCIDENT CONTROL

A non-technical course dealing with the organization and administration of a comprehensive accident prevention program. It will include an analysis of the basic industrial hazards, the various factors involved in industrial accidents with corrective action; the responsibilities and functions of top management, the safety engineer, the supervisor, and the safety committee; the training of employees, supervisors, and other management personnel; the investigation and analysis of industrial accidents; protective equipment and clothing; maintaining management and employee interest.

2½ semester hours credit

IM 14 MATERIALS MANAGEMENT SEMINAR

This course is to give the mature experienced student an insight into the managerial responsibilities of a materials control function. This seminar treats the subject with a case study, conference approach, in which the class operating as a team of industrial engineers sets up a materials control function, staffs it, writes up job descriptions and flow charts, designs forms and sets up policies. The areas covered are customer service, ordering, scheduling, dispatching, purchasing, receiving, stockkeeping, warehousing and shipping.

(Prerequisite, IM 8-9)

2½ semester hours credit

IM 15 MANUFACTURING MANAGEMENT SEMINAR

This course approaches the problems of manufacturing operations as experienced on the plant manager level. Reflecting the various elements involved in production planning and control, it is concerned with the economics of production when considering the aspects of specialization, simplification, standardization, and diversification as well as expansion, contraction, or integration. It includes such factors of production as materials, plant location and layout, power, maintenance, labor supply, organization, wage policy, etc., and concerns itself with considering the controls of the manufacturing processes, i.e., product development, scheduling, inventory, quality, cost, and budgetary controls. $2\frac{1}{2}$ semester hours credit

(An advanced level course with enrollment only by approval of the Dean)

IM 20 MANAGEMENT STATISTICS — QUALITY CONTROL

This course is required for all students enrolled in the Production or Industrial Management curricula. This course is an introduction to the elements of statistical quality control and its use to attain reduction in scrap and rework, lower costs, and reduce complaints. Emphasis is on the solution of production and engineering problems with the aid of statistical tools to prevent the manufacture of defects. Statistical principles are demonstrated practically rather than mathematically, and actual case histories illustrate principles and methods.

The subject material includes determination of machine and process capability, use of histograms to identify abnormal variability, the use of quality control charts for measurable and nonmeasurable quality characteristics, rational determination of tolerances, scientific sampling methods for process control, acceptance sampling of material by lots and the use of Military Standard 105B, current government quality control requirements, and psychological factors in controlling quality.

(Prerequisite, Ec 20)

2 semester hours credit

IM 21 ADVANCED QUALITY CONTROL

This course is designed primarily for those who require a more detailed understanding of the application of quality control techniques. The material covered in Quality Control is enlarged on and a number of the more recently developed techniques are treated in detail. Application of the methods to several particular industries, such as metal-working, textile, aircraft, chemical process, electron tube, screw machine products, is studied.

Subjects covered are special purpose control charts; multi-vari charts; pictograms; PD-diagrams; the Lot Plot inspection method; narrow-limit gauging; variables sampling plans; the Span Plan for process capability analysis; principles of visual inspection; establishing quality assurance; check inspection methods; special trouble-shooting techniques. Each student conducts a term project involving application of the methods in his own field.

(Prerequisite, IM 20)

$2\frac{1}{2}$ semester hours credit

IM 22 MANAGEMENT OF QUALITY CONTROL

A major consideration for effecting a successful quality control program lies in its administration. This course is pointed at bringing an appreciation of the non-technical aspects of administering a quality control program. In developing these concepts, intensive discussion is given to economics of quality; relation of design and inspection to quality of quality; organizing for quality control; quality control engineering; integration of quality functions; methods of obtaining quality assurance; and case studies.

(Prerequisite, IM 20)

$2\frac{1}{2}$ semester hours credit

IM 23 QUALITY CONTROL ROUND TABLE

An integrating course for those who have completed all or a majority of the courses in Quality Control. Basically designed to test the application of the students' knowledge to actual industrial situations, most of the work revolves about the students' own problems. For this reason, the course is strictly limited to those who have a full background in the subject and are in a position to devote outside time and industry to the application of quality control technology. Practice in written and oral report presentation is afforded, with emphasis on methods of selling ideas through reports. The psychology of selling statistical ideas to management is discussed. Weekly round-table discussions are held at which the students are expected to contribute their own experiences. The outside work project constitutes a large share of the course work.

(Prerequisites, IM 20-21, 22)

$2\frac{1}{2}$ semester hours credit

IM 24 RELIABILITY ENGINEERING

Complexity of design with the necessity for infallible performance of the product in the field under increased stress levels is characteristic of the requirements placed upon the manufacturer of military equipment, and on a more limited scale materials and parts for civilian goods. Accompanied by tighter specifications and shorter lead time between design and finished product, these requirements have created the necessity for a new field of activity involving the collection and analysis of data relating to design, production, and field performance of the product in terms of reliability factors. The course will cover in sequence reliability concepts, Definitions and Military Specifications. It then deals with contract negotiations involving reliability program planning, funding, organization and supervision along with reliability activities prior to and after design release. It examines vendor and subcontractor reliability requirements, considers system evaluations and reliability data. It concludes with a study of basic reliability statistics and quality control with a projection of future trends for this area.

(An advanced level course with enrollment only by approval of the Dean) 2½ semester hours credit

IM 30-31 PLANT LAYOUT

This course is taught on a combination lecture and laboratory method using the latest techniques and equipment employed in industrial practice. Instruction proceeds principally by the project method where a plant site is chosen for the manufacture of a specific product. The product is analyzed to determine the processes involved, the number and types of machines and auxiliary equipment necessary for manufacture. Flow charts are prepared and machine and equipment location determined using A.S.M.E. approved two-dimensional templates and three-dimensional scale models.

In addition to the physical arrangement of machines and equipment, consideration is given to the layout of utilities such as power, light, water, sprinklers, drainage, telephones, heating equipment, lavatories, etc. Alternate layouts are considered and all cost factors including estimates of construction changes are evaluated to determine most economical layout. Detailed attention is given to the layout of office areas and departments servicing production as well as areas designed for employee safety and convenience. Design is checked for conformance to local and state regulations pertaining to building codes, zoning, safety, and fire protection. Finished layout drawings are prepared for presentation to management.

(Prerequisites, IM 5, 8-9, 11)

5 semester hours credit

IM 32 INDUSTRIAL EXPERIMENTATION I

The two main problems confronting experimenters in the laboratory and in the factory are the evaluation of data and the design of experiments, both simple and complex. Statistical methods for solving these problems are essential tools of the process engineer and factory trouble-shooter. This course in statistical methods is specifically directed at quality control, engineering, laboratory and other personnel who wish to increase their skill and efficiency in design and analysis of experiments.

Modern small-sample techniques are applied to industrial problems. The use of statistical inference to make estimates and set confidence intervals of key characteristics of production lots and processes, design of single and multiple factor experiments, tests of significance, analysis of variance, use of the normal, binomial, Poisson, and Chi-Square distributions, as well as non-parametric methods are discussed. Short cuts and "rough-but-quick" tests are covered. Accent is on the application of these tools and to solution of typical problems. Throughout, the emphasis is on avoiding experimental blind alleys, with the associated vital savings in dollars and days.

(Prerequisites, IM 21, Ec 21-22)

2½ semester hours credit

IM 33 INDUSTRIAL EXPERIMENTATION II

The evaluation of data and the design of experiments are essential tools in laboratory research, in pilot plant development, and of the engineer and factory trouble-shooter. Consequently, this course dealing with tests of significance, analysis of variance, correlation techniques, and experimental design is specifically directed at producing greater efficiency and competency for quality control personnel as well as experimenters of all classes.

The person completing the course will be equipped not only to select an efficient design for his experimental work, but will also be enabled to make an objective evaluation of the data to determine whether the variations in the data are significantly different from those which might be expected purely on a chance basis. It is important to note that the ability to make this kind of distinction helps avoid experimental blind alleys, with the associated vital savings in dollars and days.

(Prerequisite, IM 32)

2½ semester hours credit

IM 34 INTRODUCTION TO OPERATIONS RESEARCH I

With the increasing complexity and competitive aspects of our American economy, the executive of the future must base his management decisions upon facts and data and less upon pure judgment values. Operations Research is providing, through the scientific approach, quantitative values for the several variables interacting in the problems with which the decision maker is involved in formulating policy and directing his everyday activities. This management approach to an introduction to operations research will be taught on the descriptive rather than the developmental mathematical basis. It is expected that this course will be attractive to men with science and technical educational backgrounds who are related through their employment to the operational problems which face the decision maker on all levels. Any grounding in mathematics through an introduction to calculus and a basic understanding of statistics will be helpful but not a prime requisite. Part I will be devoted to the Formulation of the Problem; the Idealized Research Model; the Construction and Solution of the Practical Research Model; Testing the Model and Solution; Establishing Controls and Putting the Solution to Work.

(Prerequisite, Ec 20-21)

2½ semester hours credit

IM 35 INTRODUCTION TO OPERATIONS RESEARCH II

Part II considers the tools and techniques which are currently available for use in Operations Research. These include Mathematical Statistics, Computers, Symbolic Logic and the many types of models such as Inventory Models, Allocation Models and Replacement Models. Case studies which demonstrate the Methodology of Operation Research and the use of tools and techniques will be used to further the student's understanding of the Operations Research approach to the "Executive Type Problem."

(Prerequisite, IM 34)

2½ semester hours credit

IM 40-41 MATERIAL HANDLING — FUNDAMENTALS

The handling of materials as an integrated part of the production program offers much promise in efficiency of operation and reduction in manufacturing costs. This course approaches the problem from both the unit workplace environment and the internal flow of raw materials through the several manufacturing processes to the storage of finished goods and their loading for shipment. Materials handling equipment will be considered in practical terms of engineering characteristics, selection for specific uses, and cost factors of operation.

(Prerequisites, IM 8-9, M 2-3)

5 semester hours credit

IM 42 MATERIAL HANDLING — PROBLEM ANALYSES

This course comprises a series of case studies, each designed to illustrate material handling problems encountered in various types of industries. In the development of the analyses, reference to source material will be required for technical data and specifications toward the selection of equipment and methods which will provide the most economic and effective operation consistent with the factors involved.

(Prerequisite, IM 40-41)

2½ semester hours credit

IM 43 MATERIAL HANDLING — COST DETERMINATION

This course is designed to thoroughly cover all elements of material handling cost including techniques in determination of cost reduction data, operating costs, replacement policies maintenance costs, etc.

(Prerequisites, A 30-31, IM 40-41)

2½ semester hours credit

IM 44 MATERIAL HANDLING — ENGINEERING PRINCIPLES

A thorough treatment of those major engineering principles which form the basis of material handling equipment design and its application. This course, which is intended primarily for those who do not have a formal engineering background, deals with such subjects as horsepower calculations, simple beams, floor loading, effect of ramps, and determination of batter requirements.

(Prerequisite, IM 40-41)

2½ semester hours credit

IM 45 MATERIAL HANDLING — CONVEYORIZATION

A comprehensive course in the characteristics, advantages, disadvantages, and practical application of all types of gravity and powered unit-handling conveyors, including skate wheel roller, live roller, belt, slat, overhead trolley, reciprocating and continuous type lifts, and drag line systems.

(Prerequisite, IM 40-41)

2½ semester hours credit

IM 46 MATERIAL HANDLING — COMMERCIAL CARRIERS

This course deals with the vital handling operations which take place after the finished product leaves the industrial plant. Considerable emphasis is given to the latest developments in commercial freight terminal handling operations, loading techniques, "on-board" handling facilities, and the material handling considerations in truck, railroad, ship, and airplane design.
(Prerequisite, IM 40-41) 2½ semester hours credit

IM 47 MATERIAL HANDLING — INDUSTRIAL WAREHOUSING

A comprehensive, practical approach to the growing problem of industrial warehousing, covering such vital fields as space utilization, distribution, stock selection, storage facilities, locator systems and equipment application.
(Prerequisite, IM 40-41) 2½ semester hours credit

IM 48 MATERIAL HANDLING — YARD HANDLING

This course gives particular emphasis to the highly specialized handling techniques used in the "fresh air" industries such as lumber, petroleum, brick, fishing and shipbuilding. In addition, thorough coverage is given to the field of yard handling of non-ferrous metals, fuel, lumber, drums, and refuse coincident to industrial plant operation.
(Prerequisite, IM 40-41) 2½ semester hours credit

IM 49 MATERIAL HANDLING — IN-PROCESS HANDLING

A new concept in materials handling associated with manufacturing and assembly operations; the role of materials handling in automation, cost control, product design, and production control.
(Prerequisite, IM 40-41) 2½ semester hours credit

IM 50 MATERIAL HANDLING — MULTI-STORY BUILDING

This course is especially well-suited to industrial New England where a high percentage of the industrial plants are multi-storied and of ancient vintage. Special emphasis is given to techniques in vertical transportation and in the maximum utilization of floors of limited capacity and poor column spacing.
(Prerequisite, IM 40-41) 2½ semester hours credit

IM 51 MATERIAL HANDLING — BULK MATERIALS

A comprehensive and practical approach to the problems inherent in the handling of fluid, powdered, granular, and lump materials.
(Prerequisite, IM 40-41) 2½ semester hours credit

INSURANCE (In)

In a complex economic structure, the function of risk bearing becomes vital. The Insurance industry has experienced tremendous growth in serving this need. The courses offered are basic in their presentation and are designed to train for effective careers in one of the many divisions of operation.

In 1-2 INSURANCE PRINCIPLES

A foundation course to an intelligent understanding of Casualty and Fire Insurance and its function in our economy; measurement of risk and rates; types of carriers, their organization, and regulation; loss adjustment and loss prevention; underwriting and reinsurance. The second semester is devoted to an examination of the insurance contract and to a brief survey of the principal forms of Casualty, Fire, Marine, Surety, and Disability insurance, and their uses.
5 semester hours credit

In 3 INSURANCE FOR MANAGEMENT

Every business manager has the responsibility for protection of the assets and continue life of his company under any eventuality. This course, approached from a management view point, discusses the various risks present in modern business operations, and procedures to be taken with types of insurance used to indemnify against anticipated losses.

2½ semester hours credit

In 4-5 CASUALTY INSURANCE

This is a comprehensive study of casualty insurance. It includes such insurance contracts as workmen's compensation and employers' liability, accident and health, schedule an comprehensive general liability, and miscellaneous crime coverages. Special attention is paid to the policy contract, various rating procedures, endorsements, the methods used to determine premium payments, insurance auditing procedures, etc. The subjects covered are considered in detail through careful analysis of the several underlying insurance contracts.

(Prerequisite, In 1-2)

5 semester hours credit

In 6-7 FIRE INSURANCE AND ALLIED LINES

This course includes the history and development of Standard Fire Insurance Policies, presenting a detailed study of the Massachusetts Standard Fire Policy, its modifying forms and endorsements; methods of rating; policy writing procedures; and loss handling. It includes study of extended coverage, consequential loss contracts, and collateral fire lines.

(Prerequisite, In 1-2)

5 semester hours credit

In 8-9 INLAND MARINE INSURANCE

Covers the origin, development and present scope of Inland Marine Insurance and a complete analysis of the provisions of transportation policies, property floaters, bailees' customer floaters and special risk policies. The course is designed to provide a thorough grounding in the fundamental principles of Inland Marine Insurance, with special emphasis on policy forms, rates, underwriting and the applicability of the coverages to the needs of the insuring public.

(Prerequisite, In 1-2)

5 semester hours credit

In 10-11 FIDELITY, SURETYSHIP, AND CRIME INSURANCE

This course is introduced by a general consideration of crime insurance. Coverage under fidelity and suretyship is discussed individually, including the various forms of fidelity, judicial contract, public official bonds, license and permit bonds, miscellaneous surety bonds, burglary and robbery insurance, and the comprehensive crime policies. The several bond and policy forms under the foregoing are studied individually, supplemented by the underwriting procedures in conjunction with the use of the manuals.

(Prerequisite, In 1-2)

5 semester hours credit

In 12 COMPREHENSIVE HOMEOWNERS POLICY INSURANCE

A course designed to meet the professional needs of men actively engaged in the insurance business. Using policy forms and company manuals as tools of instruction, the course will tackle the multitude of problems arising out of the attempt to integrate in a single policy the varied types of risks involved in the multi-peril packaging of insurance coverages. The instruction will be specifically concerned with the peculiar types of problems arising in selling underwriting, claims adjustments, etc., in the Comprehensive Homeowners Insurance. Ample opportunity will be provided for discussion of case situations encountered in the individual's practice.

2½ semester hours credit

In 13-14 CLAIMS PROCEDURE

The function and organization of the claims department; the claims adjuster, his qualifications, duties, and responsibilities; the theory and procedures of handling insurance claims. This course presupposes a knowledge of the basic coverages, and is handled on a lecture and discussion basis, using case studies, however, limited to general casualty, fire, burglary, bond, and inland marine insurance.

(Prerequisites, In 4-5; 6-7; 8-9; 10-11)

5 semester hours credit

INDUSTRIAL RELATIONS AND PERSONNEL (IR)

The management of human relations in business represents one of the most challenging aspects of our industrial developments. Opportunities are unlimited for qualified persons in all phases of management with a sound understanding of the underlying principles of labor-management relations. The continuance of our American system of industrial economy demands a more thorough understanding of the principles underlying labor-management relations and their responsibilities one to the other and mutually to the public.

IR 1 PSYCHOLOGY FOR BUSINESS

Business psychology is the study of predicting and influencing human behavior in business. It provides an understanding of man's mental life, of how the individual and the group behavior is influenced in their behavior, and of how the business man may predict and control his own behavior and that of those with whom he works. The study and analysis of the student's own personal problems and behavior constitute a valuable and interesting phase of the course.

2½ semester hours credit

IR 2-3 HUMAN RELATIONS

Effective handling of human problems has become a factor of vital importance to management. This course in human relations in business is the foundation to all personnel policy and offers an approach or understanding of value not only to those in personnel work but also to all persons having supervisory relationships. Subjects included for discussion are the techniques of approach to situation analysis; problems in selection; training; employee rating; range of employee status; supervision; wage policies; complaints and grievances; employee morale; labor turnover; discipline; health; safety; employee participation; collective bargaining; public relations.

5 semester hours credit

IR 4 PERSONNEL MANAGEMENT PRACTICES

This course, in contrast to IR 2-3, is specifically related to the organization, function, and procedures of the personnel department. It is concerned with such problems as the organization of the personnel department; its relationship and responsibility in the total management organization; recruitment of manpower; techniques of interviewing and counseling; employee selection; testing; proper job placement; training; job analysis and evaluation; merit rating; promotion, transfer, discharge; employee publications; standards and conditions of employment; personnel forms, records, and reports.

2½ semester hours credit

IR 5 WAGE ADMINISTRATION

The course is a comprehensive study of the underlying theory of industrial wages. Specific consideration is given to job and salary analysis and evaluation; merit rating; incentive wages; wage payment plans. The importance of a sound wage structure to healthy employer-employee relations and the administration of wages through collective bargaining from the production as well as the labor relations point of view.

(Prerequisite, IR 4 or 20)

2½ semester hours credit

IR 6 EMPLOYMENT TESTING

Selection and placement procedures usually comprise several steps, including the interview, psychometric testing, references, etc., all of which are fitted together to form an over-all judgment. This course is concerned with tests used in business and industry to determine aptitudes, personal characteristics and qualifications for employment, proper job placement, counseling, promotion, special training, supervisory or executive potentialities. It discusses tests in terms of type and purpose, test characteristics, test construction, test interpretation, use and limitations of testing.

(Prerequisite, Ec 20-21)

2½ semester hours credit

IR 7 PRACTICAL TRAINING METHODS FOR BUSINESS AND INDUSTRY

Subjects covered range from principles and methods of effective "on-the-job" training to the handling of formal or informal training groups. The objective is to provide a thorough grounding in the psychology of learning; techniques of effective teaching; personality qualifications for successful training; a review of job instruction training (J. I. T.) and job relations training (J. R. T.); use of the case analysis method; role playing; training tools; visual aids; the value of example and demonstration; methods of analyzing and meeting training needs; the principles and practices of organizing and administering a training program; follow-up procedures to insure results; class projects to provide practical application of material covered in the course.

2½ semester hours credit

IR 8 TECHNIQUES OF SUPERVISION

Supervision is the function of directing, controlling and co-ordinating the combined effort of men, machines and materials. Positions of managerial capacity involve the responsibility of supervision. This course is designed to provide basic instruction in such phases as the supervisor's responsibilities and objectives; planning the work and employee assignment; employees' attitudes toward management, equipment and materials; records and reports; improving individual performance; progress of employees; personnel relations; handling grievances; training; administering of company policies; matters related to wages; the development of a congenial, enthusiastic community of work interest through the co-ordination of the work of all employees.

2½ semester hours credit

IR 20 LABOR-MANAGEMENT RELATIONS

This course provides a basic treatment of labor economics, including the history of the labor movement and of industrial relations, with emphasis on the present period; theory of collective bargaining; effect of collective bargaining upon income of labor, employment, accumulation of capital, and national income. Policies and practices of labor and management in respect to hiring and layoffs, technological changes, wages and market position, closed and open shop union-management co-operation, government regulation of labor relations, etc. The problem of strikes and lockouts and public policy as to industrial relations are covered.

CORE COURSE

2 semester hours credit

IR 21 LABOR LEGISLATION — UNION-MANAGEMENT RELATIONS

A study of the legal framework for collective bargaining, beginning with the historical development and the impact of the anti-trust laws on labor unions, and continuing with the federal and state laws regulating injunctions in labor disputes; the Railway Labor Act; the National Labor Relations Act; a detailed study of the Labor-Management Relations Act (Taft-Hartley); the procedures, powers, and limitations of the agencies administering the statutes.

(Prerequisite, IR 20)

2½ semester hours credit

IR 22 LABOR LEGISLATION — STANDARDS AND CONDITIONS OF EMPLOYMENT

A course covering the content and relationship of federal and state regulation of wages, hours and working conditions, including minimum wage, hours of work, and child labor legislation. Old age and survivors, unemployment and workmen's compensation insurance programs are also covered as well as the anti-discrimination laws covering veterans' re-employment rights and fair employment practices.

(Prerequisite, IR 20)

2½ semester hours credit

IR 23 THE LABOR AGREEMENT — NEGOTIATION AND ADMINISTRATION

The negotiation, re-negotiation, and administration of labor contracts; study of the component clauses such as union recognition and security, management prerogatives, seniority, vacations, wages, hours, working conditions; grievance analysis and arbitration procedure developed through case studies in actual labor-management relations as affected by such clauses, and the entire collective bargaining agreement and relationship.

(Prerequisite, IR 20)

2½ semester hours credit

IR 24 LABOR RELATIONS SEMINAR

An advanced discussion of current labor-management problems such as union responsibilities, management responsibilities, the annual wage, profit sharing, criteria for wage determination, welfare programs, etc. Cases under consideration will cover problems that are timely and specific. Class limited in size.

(Prerequisites, IR 20, 21, 22, 23)

2½ semester hours credit

IR 25 YOUR PERSONALITY

This course is designed to help the student appraise his inner resources so that he might be better prepared to meet the outer pressures of life. It deals fundamentally with the principles of psychology of personality. Through a personalized approach, this "inward-looking" course enables the individual to interpret his behavior and to develop an understanding which will help him to improve his relationships with others. The course also considers methods of measuring characteristic traits, aptitudes, interest, attitudes.

1¼ semester hours credit

IR 26 CAREER PLANNING

Professional success is the result of well-defined objectives activated by an organized plan of procedure. This course considers the basic elements in life planning divided into the aspects choosing one's life work; the continuing relationships and activities involved in professional development; and the broader concepts of planning for a well-rounded life. It endeavors to provide a systematic basis for the development of a personal profile of abilities and interests — realistic self-evaluation of these factors in terms of one's future. It includes the techniques of self-evaluation as well as consideration of those factors involved in professional growth.

1 1/4 semester hours credit

LAW (L)

Underlying the ever-increasing complexity of modern business is a growing body of law which defines and directs business operations.

L1-2 LEGAL ASPECTS OF BUSINESS I

Contracts: nature, kinds and formation of contracts; essential elements; form and interpretation of contracts; breach, remedies and damages. Agency: nature, purpose and formation of agency relationship; rights and duties of principal and agent, scope of agent's authority; rights and duties of principal and third persons; termination of agency. Employer and employee: compensation laws; duties of master; contributory negligence doctrine; injuries to third persons. Bailments: nature and kinds; rights and duties of parties. Negotiable instruments: bills, notes and checks; requirements of a negotiable instrument; negotiation; liabilities and defenses of parties; procedure upon dishonor; discharge. Personal property: nature and classification, methods of acquiring title. Sales: nature of sales contracts; warranties; transfer of title; rights and remedies of seller and buyer.

CORE COURSE

4 semester hours credit

L3-4 LEGAL ASPECTS OF BUSINESS II

Transportation: duties and liabilities of common carriers. Insurance: formation and function of insurance contract; kinds of policies; legal phases of life, property and other insurance. Suretyship: rights of the surety and the guarantor; rights and duties of the creditor; defenses of the surety and guarantor. Partnerships: nature, kinds and formation; rights and duties of partners; partner's authority to bind firm; relation of partners and third persons; dissolution and winding up. Corporations: nature and creation; charter; powers, rights and liabilities; nature and kinds of capital stock; rights and liabilities of stockholders, directors and officers. Mortgages: rights and duties of mortgagor; rights and duties of mortgagee; rights after default. Real property: landlord and tenant relationship; classification of tenancies; rights and duties of landlord; rights and liabilities of tenant. Trusts and decedents' estates: wills and intestacy. Bankruptcy: Federal Bankruptcy Acts; acts of bankruptcy; adjudication; rights and duties of bankrupt; unsecured, secured and priority claims; extensions, compositions, and other debtors' relief provisions; discharge.

CORE COURSE (Prerequisite, L 1-2)

4 semester hours credit

LIBERAL ARTS

Courses in the Liberal Arts represent an integrated program which touches upon the humanities as well as the physical and social sciences to provide a well-rounded background of understanding essential to modern business management.

Recent economic and technological trends, projected at an accelerated rate into the years immediately ahead, are making phenomenal changes in the requisites of the business manager of the future. Developments in "management science" are struggling to keep pace with technological "know-how." The leading thinkers who have charted the course of civilization throughout the ages are making us conscious of the new range of responsibility for leadership in today's complex and interdependent society. Our future destiny depends upon a more active understanding of these interrelationships and interresponsibilities. It is the function of education to prepare for this new type of management leadership by providing the student with an insight into human nature, the forces that have shaped his cultural inheritance, and the recognition of the growing importance of business in society and world affairs.

The purpose of education has often been expressed as twofold: (1) teaching the student how to earn a living and (2) teaching him how to live. The first objective is approached through professional courses comprising our several curricula in business administration.

Successful and happy lives are built, however, upon a knowledge and understanding of the varying environments which envelop one's activities and associations, accompanied by an ability to adjust to the changes ever present in a dynamic society. It is felt, therefore, that the second objective can best be achieved through an integrated and sequential pattern of instruction which, viewed through the eyes of the individual, considers in a sequential evolution the forces which affect him as an individual and govern his activities as a member of society. Such a total pattern of instruction of necessity calls upon the store of knowledge gathered by man over the ages. However, to achieve this objective in a professional program it should not be presented as knowledge for knowledge's sake, but being man-centered it concept relates this knowledge to develop within the student a better understanding of himself, and a sensitivity to his varying environments which in effect comprise his life. It should help to develop within him a social consciousness of his responsibilities to society and stimulate the development of philosophical concepts which he can use to govern his life pattern.

LA 1-2 MAN AND HIS PHYSICAL UNIVERSE

One of the primary functions of any modern educational system is to give those exposed to its influence an opportunity to see themselves in true perspective in relationship to the sweep of time and the stretch of space. The extent of man's knowledge and the very fact that there is a fundamental unity of nature prescribes that the artificial departmental frontier be broken down.

It is natural, therefore, that this sequence designed to acquaint the student with his relationship to his various environments should start with his physical universe — the physical universe with its fixed laws of science — and move gradually yet continuously to the uncharted realms of man's quest for guiding philosophic concepts. The acquaintanceship thus established should liberalize his thinking and develop within him a sense of belonging of participation, an "at homeness" in the world in which he lives.

The pattern is a constant unfolding of man's conquest of nature and opens with a consideration of the earth as an astronomical body and of our neighbors in space. It proceeds into the nature of matter and energy and their applications to everyday living, the physics and chemistry of modern industrial developments, as well as the more recent developments in atomic research.

It relates man to the controlled changes in his physical environment through an understanding of some aspects of the world's work, its material resources, and some elements of communication. The inanimate structure is concluded by a consideration of the uncontrolled elements such as meteorology and the constant process of geologic change in which the history of man is written.

Moving from the inanimate, we next find man as one of the endless variety of life on the earth. Life is a profound mystery. No one knows with certainty where it came from originally nor has been able to explain exactly what it is. Study over the years, however, has unraveled some of this mystery. For instance, life became associated with protoplasm which requires a constant supply of food; living organisms must provide for the perpetuation of their own kind; and that to continue, living things must adjust themselves to their environments resulting in a constant process of evolution or extinction. Nature maintains its own balance and serious effects result from man's disturbance of this balance of nature. Science has made extensive discoveries relative to the nature and control of disease, and the application of Mendelian principles has aided in the improvement of living species.

Man has learned that he must depend upon living things for food and an abundance of other materials for his complicated activities. He needs to know how his own body operates in order to take care of it. Not only the intelligent conservation of man's resources but actually his continuance as a species requires an understanding of the factors which affect all forms of life. These broad objectives are studied within the framework of the history of life, the geophysical haunts of life, the abundance of life, and the value of life.

6 semester hours credit

LA 3-4 MAN IN SOCIETY

Business today accepts the basic precept that management must get things done through people. This necessitates a clearer understanding of the anthropological, biological, and psychological factors and forces which govern and direct man's actions. Thus, from the broad study of the biotic world, the sequence now moves to a study of man, both as an individual and as a member of society.

Before one can adequately understand others, he first must understand himself especially as seen through the eyes of others. Therefore, this course, based upon the fundamentals of general and differential psychology and the dynamics of personal adjustment, takes a

rospective approach in terms of the student's relationships with others to provide an understanding which might result in effectiveness, happiness, harmoniousness, and fullness of satisfaction in his daily living. The course recognizes the needs and motivations which motivate one's activities as well as the changing pattern involved in the process of maturation and aging.

We next move into a consideration of the relationships of man within the basic units of society and the problems encountered in his efforts to live together. Here we must consider the norms which give structure, stability, and order to society through which the factors involved in the individual patterns of social behavior develop into the broader institutional patterns of the family, the church, the community, industry, and governments, both national and international. The student is made to recognize that society is in a state of constant flux and he is introduced to some of the factors which create this constant change.

(Prerequisite, LA 1-2)

6 semester hours credit

LA 5-6 MAN'S CULTURAL INHERITANCE

Culture is a complex web covering all aspects of life, and every culture is derived from many sources. It is an accretion of the ages and the result of multifarious influences, emotional orientations, and precepts, which profoundly influence social behavior. It finds its roots in anthropology — the study of man — and the changing pattern of man's experiences throughout history.

Culture is a uniquely human phenomenon. No culture can exist divorced from living beings, for culture and society are inseparable. Among all the creatures of the animal kingdom, man stands alone in his ability to create and sustain a culture. Cultures are processes of behavior constantly changing and modifying and vary at times quite widely even within limits of a social pattern. It is a composite abstraction usually approached through the study of anthropology, culturology, the social and political sciences, economics, and history, and its expression in literature, art, music, etc.

We as Americans have a rich heritage which has come to us from many areas and civilizations. It is a heritage which in terms of material and spiritual values has raised man to his highest heights. As one philosopher expressed it, however, every living thing contains within itself the seed of its own destruction. Therefore, the preservation of our cultural inheritance can come only through a firm understanding and recognition of the sacrifices which have entered into the development of our complex social, economic, and technological development to date. The culture we pass on to posterity will be wise and well directed only as we learn and profit from the history of man over the ages.

Thus this course of necessity must be a composite arising out of fundamental questions regarding the nature of man, his life, the structural organization of human society and the needs and issues out of which his ultimate destiny will develop. Out of such thinking, education must develop the leadership for a free world.

(Prerequisites, LA 1-2, 3-4)

6 semester hours credit

LA 7-8 MAN AND VALUES

There is an important sense in which every man must be his own philosopher, just as in a democratic society citizens exercise political choice and make political decisions even though they do not actively engage in politics or hold political office. For every man must live his own life in a universe which he did not create, in conflict with obstacles against which he must constantly push, and he must make choices and decisions which exhibit his values and appeal to his preferences. If his life is not to be merely mindless, and if he refuses to permit his actions to be simply the result of drifting or the spineless acceptance of the values of others, then he must come to some conclusion about the values which he wishes to prevail and the nature of the universe in which he lives. Such conclusions are bound to be philosophical.

Every man recognizes a relationship with the infinite. In his search for the moral and ethical concepts through which he can express this relationship he must explore the experiences of others through their meditative writings. These at times are expressed in the literature of the great books which have shaped man's development, and again in the more profound treatises on philosophy, social ethics, comparative religions, etc. Everyone, whether he realizes it or not, has a personal philosophy whether he be ignorant or broadly educated.

It may be narrowed and circumscribed by doubts and fears or it may be synthesized from an understanding of the broad gamut of man's thinking, resulting in positive beliefs and intellectual freedom. Every successful life has been wisely charted.

(Prerequisites, LA 1-2, 3-4, 5-6)

6 semester hours credit

MATHEMATICS (M)

M 1 PREPARATORY MATHEMATICS

An intensive problem-solving course in arithmetic and high school algebra. Topics include manipulation of common and decimal fractions, percentages, interpolation in common reference tables, and solution of simple algebraic equations. An important part of this course is discussed, with application drawn from business and industry, as well as from engineering and the sciences. The main concern is to establish an understanding of the fundamental mathematical processes and to acquire facility with modern computational techniques and aid including the use of alignment charts and the slide rule.

Non-credit

M 2-3 MATHEMATICS

This course is the normal prerequisite for all later courses in mathematics, statistics, and quality control. During this one-year course, basic mathematical principles and techniques are discussed, with application drawn from business and industry, as well as from engineering and the sciences. The main concern is to establish an understanding of the fundamental mathematical processes and to acquire facility with modern computational techniques and aid including the use of alignment charts and the slide rule.

Practical work includes problems in graphic presentation, simple analytic geometry, solution of triangles, manipulation of exponents and logarithms as well as a survey of selected topics in the field of topology and symbolic logic. Entrance into this course is predicated on successful completion of the Preparatory Mathematics diagnostic examination which will be administered the first meeting of this class.

CORE COURSE

4 semester hours credit

M 4-5 GRAPHIC AND MATHEMATICAL TECHNIQUES IN INDUSTRY

This lecture and laboratory course is designed to provide students with elements of mathematical techniques and shop drawing essential to study in the field of industrial and production management.

Instruction in shop drawing includes the use of drafting equipment, the principles of orthographic projection and sketching, blueprint reading, and systems of dimensioning indicating limits and tolerances, designation of locating points, and commercial finishes.

The second half of the course is designed to give the student a working knowledge of plane trigonometry, analytic geometry, and the calculus. The student will have an opportunity to practice his skill in solution of more complicated equations and to find maxima and minima as well as deriving equations for velocity and acceleration in common physical phenomena. The use of determinants in the solution of simultaneous equations and design of alignment charts is demonstrated for problems drawn from industry.

(Prerequisite, M 2-3 or equivalent)

4 semester hours credit

700 PRE-ENGINEERING MATHEMATICS

This course is devoted to a thorough study of Algebra I and Plane Geometry.

701 ALGEBRA

Although the primary purpose of this course is to lay a thorough groundwork for the subsequent courses in analytic geometry, calculus, and applied mechanics, it is nevertheless a complete unit in itself, and will enable the student to handle a considerable number of the problems arising in engineering practice.

Proceeding from a rapid review of the fundamental operations of algebra, the work continues with a thorough study of fractions, functions, linear and quadratic equations, equations in quadratic form, graphs, exponents, complex numbers, binomial expansion, variation, and equations of higher degree than the second.

(Prerequisite, 700 or Mathematics Placement Test)

3 semester hours credit

702 TRIGONOMETRY

This course includes the solution of all triangles by both natural and logarithmic function identities, radian measure, principal values and the solution of trigonometric equations. Particular attention is given to the applications of trigonometry to engineering practice.

(Prerequisite, 701)

3 semester hours credit

703 ANALYTIC GEOMETRY AND DIFFERENTIAL CALCULUS

This course provides a smooth transition from algebra and trigonometry into the calculus. Included are the studies of the straight line, the circle, and conic sections, using rectangular ordinates only. The graphs of trigonometric, logarithmic, and exponential functions are covered. Then follows the differentiation of algebraic and transcendental functions, both explicit and implicit, with some applications. Slopes of curves, maxima and minima, derivatives of higher order, velocity and acceleration in rectilinear motion are included.

(Prerequisites, 701, 702)

3 semester hours credit

704 INTEGRAL CALCULUS

This course deals with integration as the inverse of differentiation as well as the limit of summation. The topics covered are methods of integration; use of integral tables; differential equations with separable variables; the differential equation of rectilinear motion; definite integrals; areas in rectangular co-ordinates; length of curves; areas of surfaces of revolution; volumes of solids of revolution; multiple definite (iterated) integrals; centroids of plane areas; moment of inertia.

(Prerequisite, 703)

3 semester hours credit

OFFICE MANAGEMENT (OM)

Office management has developed rapidly in scope and status in response to the technical and diversified nature of the problems arising and the current trends toward the scientific approach to the solutions of these problems.

OM 1 OFFICE MANAGEMENT PRACTICES

This course considers the organizational, human, physical, and operational problems encountered by the manager of the modern office. It stresses the importance of the proper use of the office management function in effective company organization; the value of proper selection techniques, supervision, adequate compensation policies, and employee relations in building up an office force with desirable attitudes and abilities. It discusses principles of efficient office layout; working conditions; the analysis of office methods and systems; work simplification; the selection and use of office machines; and common office functions. Every effort is made to use the student's own office background as a sounding board for the subject matter.

2½ semester hours credit

OM 2 SCIENTIFIC MANAGEMENT IN OFFICE PRACTICE

This course is intended to provide basic instruction in the tools of modern scientific management, work simplification, time study, job evaluation and merit rating; work simplification as a means of improving work methods and procedures through motion study and process analysis; time study for work measurement and the establishment of standards; and job evaluation for determining the equivalency among the several jobs as a basis for a wage and salary structure. These scientific tools will be applied to office practices. Laboratory exercises will accompany the lectures.

(Prerequisite, OM 1)

2½ semester hours credit

OM 3 BUSINESS ORGANIZATION AND ADMINISTRATION

This course gives recognition to the function of management as an identifiable, measurable and transferable activity. The ever-increasing complexity of our economy has forced business men to look not only at the adequacy of their facilities, equipment, and methods of operation but also the organization of their management leadership structured to accomplish their companies' objectives through "people." The approach in this course will concern itself first with the profession of management in terms of its nature in its historical evolution to the modern concepts of centralization, decentralization, management by committee, and the unified concept of management including line and staff relationships, the use of specialized staff, as well as top management organization. Referral will be made by application to selected companies which have pioneered in this area by appropriate case studies. Organizational structures will be analyzed, organizational manuals defining responsibilities, accountability and programs of management development of employed personnel will be explored. Consideration will be given to the dynamics of organization involved in organizational structure changes and the problems incidental to such change.

(An advanced level course with enrollment only by approval of the Dean)

OM 10 OFFICE SYSTEMS AND PROCEDURES

This course is devoted to the techniques of system design to most effectively record and expedite the operations of the office and/or the factory. It deals with the elements of system analysis; methods of obtaining data and recording of existing procedures; procedure charting and charting techniques; developing, testing, installing, and adjusting new systems; measuring effectiveness of the system. Considerable time will be devoted to laboratory analysis of certain recognized systems and for the discussion of design problems submitted by members of the class.

(Prerequisite, OM 1)

2½ semester hours credit

OM 11 FORM DESIGN AND CONTROL

Forms in their relationship to office systems; forms designing tools, drafting techniques, factors and principles of form design; problems of paper size and quality for specific uses; carbons, typography and printing specifications; forms housing; the design of general and specialized forms including system cards, visible file cards, tickets, bookkeeping and addressing machine forms, carbon interleaved forms, reproduction forms (hctograph and offset processes), strip accounting forms; forms control organization and administration.

(Prerequisite, OM 10)

2½ semester hours credit

OM 12 SYSTEMS ANALYSIS AND IMPROVEMENT

Tools and techniques of the systems analyst; the humanics of systems analysis; developing and presenting recommendations; setting up pilot operations; selling management and to workers; installing and checking the new operation. This course is conducted on the case method, using all of the tools of the systems analyst, i.e., process chart, procedure flow chart, forms distribution (flow) chart, work distribution chart, layout flow chart, reports control chart, work measurement (productivity) chart, etc. Some problems are presented at the actual location through plant visitation.

(Prerequisite, OM 10)

2½ semester hours credit

OM 13 PUNCH CARD MACHINE METHODS I

This course consists of chalk talks, diagrammatic wiring, as well as actual control panel wiring and testing on electric accounting machines. Basic and advanced Control Panel Wiring will be taught on the following I.B.M. Electric Accounting Machines: Reproducing Punch (Type 514); Alphabetical Accounting Machine (Types 402-3 and 405); and Collator (Type 077). It will also cover functional card design and the integration of machine usage in the scheduling and flow of work.

Special course, non-credit

Designed specifically for I.B.M. Electric Accounting Machine Supervisors and Operators

OM 14 PUNCH CARD MACHINE METHODS II

An advanced course, continuing beyond Punch Card Machine Methods I to include I.B.M. Accumulating Reproducer (Type 528) and Electronic Calculating Punch (Type 604). Prerequisite for this course is satisfactory completion of Punch Card Machine Methods I or equivalent in experience (usually at least three years of responsible employment as an operator or a supervisor).

Special course, non-credit

Designed specifically for I.B.M. Electric Accounting Machine Supervisors and Operators

OM 15 ELECTRONIC DATA PROCESSING FOR BUSINESS

This course is planned to acquaint the executive, accountant, methods and systems analyst with automatic electronic equipment and its potential applications. It will include a comprehensive survey of the machine components of such systems, their characteristics, and assembly to handle various business accounting problems; comparison of speed, capacity, flexibility, reliability and cost; discussion of input and output devices; general and special purpose computers and how they work, memory (storage), arithmetic and control elements, elements of programming, number systems, integrated data processing in business, economic advantages of automation and various applications in retail sales, inventory, payroll, and banking accounting. Special attention will be given to the smaller systems which are expected to gain wide acceptance.

2½ semester hours credit

OM 16 ELECTRONIC DATA PROGRAMMING

An advanced course intended to further acquaint business managers, accountants, methods and systems men, etc., with a general knowledge of programming techniques in order that they may better evaluate the capabilities of the several types of equipment designed for both small and large systems.

The course will include a brief review of program concepts with particular emphasis upon the stored program technique; the order structures used in a typical single address variable word length system and a three address fixed word length system; flow charting techniques; actual demonstrations and exercises in programming typical business applications for both single and three address systems in the university computation center; symbolic programming and automatic programming.

(Prerequisite, OM 15 or the equivalent in experience)

3 semester hours credit

REAL ESTATE (RE)

Real Estate occupies an important position in our social economy. The courses in this department are practical in their approach, designed to provide the necessary tools for those planning careers in any of the several phases of operation within this field.

RE 1 REAL ESTATE FUNDAMENTALS

This course examines real estate's place in our social economy. The operation and forces of the market itself, and its relation to over-all public interest; it includes land economics and development, the market, building and its problems, building construction, brokerage, starting a real estate business, mortgage lending, remodeling, insurance, planning and zoning, Government Legislation — V.A. Loan Guaranty and Federal Housing Administration insurance on G.I. and non-G.I. loans.

2½ semester hours credit

RE 2 REAL ESTATE LAW AND CONVEYANCING

This course covers the legal processes and instruments used in controlling real estate ownership and transactions involving the acquisition, use, enjoyment and disposition of real estate and including land titles, estates, contracts, agreements of sale, deeds, mortgages and foreclosures, easements, liens, leases, landlord and tenant relations and liabilities, purchase and sale of real estate, conveyancing, wills and probate, building and zoning laws, and insurance.

(Prerequisite, RE 1)

2½ semester hours credit

RE 3 REAL ESTATE MANAGEMENT AND INVESTMENT

This course offers more of a practical than theoretical approach to the relationship which exists between real estate investment and management, placing particular emphasis on the advantages and risks of investment in real estate, types of real estate investments, the workings of the real estate operator with regard to exchange of real estate and speculation, financing of real estate purchase and development, the relation of investor to manager and broker, real estate management as a business, the organization of a management department in a brokerage firm, management policies, rent and rental problems, the fundamentals of apartment house management and co-operative apartments.

(Prerequisites, A 30-31, RE 1, 2)

2½ semester hours credit

RE 4 REAL ESTATE FINANCE

An advanced course dealing with the current methods of financing real estate, especially designed for realtors, bankers, attorneys, appraisers, as well as students pursuing the real estate program. It considers banking systems, instruments of finance, including discussions of long-term leases and bond issues; techniques of mortgage lending; appraising; financing various types of real estate; the effect of income taxes on financing. The functions of the real estate broker and the government financing agencies form a base for this course. They are complemented by discussions pertaining to the influence of federal financing institutions upon the field of real estate as a segment of our economy.

(Prerequisites, RE 1, 2)

2½ semester hours credit

RE 5 REAL ESTATE SALES AND ADVERTISING

The selling of real estate calls for specialized applications of the principles of selling and advertising, basic to which are the techniques of property listing; the securing, classifying and analyzing of prospects; methods employed in selling the various kinds of residential, business and industrial properties; creative selling; trading and exchanging; financial aids in selling; the economics and techniques of advertising; women in the field of real estate sales.

(Prerequisite, RE 1)

2½ semester hours credit

RE 6 OPERATING A REAL ESTATE BUSINESS

For the person who is about to enter the real estate brokerage business, and as a refresher course for those already established in the business, this course offers new ideas from authoritative sources, as well as general principles and practices of the business. Included in the course are lectures and discussions on what real estate embraces, getting started in the real estate business, establishing an office, pitfalls to avoid, the art of selling, the sale from start to close, land subdivision, renting and leasing, women's field in real estate, hiring and training salesmen, advertising, publicity and promotion, and compensation for brokers and salesmen.

(Prerequisite, RE 1, 2)

2½ semester hours credit

RE 7 REAL ESTATE APPRAISAL — RESIDENTIAL PROPERTIES

This course is designed to provide the student with the basic knowledge and tools necessary to enable him to appraise residential properties. Study is made of valuation concepts, the purposes of appraisal; the sources of, collection, and application of data used to prepare appraisals; the use of tables, residual techniques; special purpose properties, the summation and final estimate of value, and the writing of appraisal reports; preparation and presentation of expert court testimony.

(Prerequisites, RE 1, 2)

2½ semester hours credit

RE 8 REAL ESTATE APPRAISAL — COMMERCIAL AND INDUSTRIAL PROPERTIES

Presented in this course is the analyzing of business neighborhoods, the special appraisal functions, as applied to the following commercial and industrial properties: various types of business properties, retail store properties, heavy and light manufacturing properties, warehouse and waterfront properties, special purpose properties, banks, indoor and outdoor theaters, garages and gasoline stations, office buildings, combination store and offices, hotel apartment buildings; the appraisal reports.

(Prerequisites, RE 1, 2)

2½ semester hours credit

RE 9 SMALL HOME CONSTRUCTION AND ESTIMATING

A practical and authoritative presentation of information invaluable to the contract builder, the real estate operator or the owner-builder regarding residential construction, remodeling or repair.

The course deals specifically with the types of house architecture; house styling; model subdivision methods; construction details from foundation to roof; selection, scheduling and specifications of materials, equipment and services; plans and plan reading; construction specifications; estimating costs of materials, labor, etc.; budgeting finances.

2½ semester hours credit

RETAILING (R)

Retailing occupies one of the major steps in the important field of distribution. Rapid changes in retail merchandising practices create complex and difficult problems, making a knowledge of modern control methods necessary.

R 1 RETAIL STORE MANAGEMENT

Development of modern retail organizations, including smaller and larger retail store location and layout, wage payment methods, selling services, receiving and marking procedures, mail and telephone orders, adjustments, delivery of merchandise, retail accounting and control, and store protection and maintenance.

2½ semester hours credit

R 2 RETAIL STORE MERCHANDISING

This course presents the fundamental principles of retail store merchandising, including determination of customer demands, purchase planning, pricing, markups and markdowns, merchandise inventories, turnover, merchandising policies, and retail sales promotion. Particular emphasis is given to the emerging pattern of retailing in this country, including the growth of suburban stores, discount stores, and self-service operations. The course is presented through short cases and problems taken from actual operating experience of large, medium and small stores.

(Prerequisite, R 1)

2½ semester hours credit

R 3 RETAIL STORE ADVERTISING

This course is devoted to the study of the elements of retail advertising. The various media used by retailers are considered with drill in the preparation of effective retail copy. A study is made of institutional, straight merchandise and sales copy as exemplified in current advertising of important retail concerns. The principles of layout receive attention as well as the mechanics of production, including art work, plates, typography, and printing. The aim is to furnish a practical foundation fitting students for a creative career in retail advertising.

Prerequisites, D 20-21, R 1)

2½ semester hours credit

R 4 MERCHANDISE DISPLAY FOR SALES PROMOTION

Display as a tool of sales promotion; the function and organization of the display department in the promotion of merchandise through interior and exterior displays; selection and preparation of merchandise for display; the use of display fixtures; creating display arrangements and determining most effective locations; store traffic; impulse buying; display problems of the small stores; seasonal backgrounds; color and illumination effects in window and end displays; planning and budgeting to co-ordinate with store merchandising and management policies.

Prerequisites, D 7, R 3)

2½ semester hours credit

TRANSPORTATION AND TRAFFIC MANAGEMENT (T)

The rapid changes in several phases of the transportation industry are creating many entirely new concepts in the methods and economics of business operation. The transportation courses below are designed to present a practical approach to the basic principles and practices of current procedures and operations.

T 1 TRANSPORTATION PRACTICES

The importance of transportation in the American economy; a comparative evaluation of various available transportation services from the point of view of cost, total time in transit, reliability and geographical coverage, including movement of freight by rail, motor, water and air carriers, freight forwarders, parcel post and express as well as combinations and modifications of each; classification of freight; rules of classification; basic studies in rates and tariffs; freight claims, transportation insurance and warehousing. The basic factors involved in cost control are introduced.

2½ semester hours credit

T 2 TRAFFIC MANAGEMENT

The application of the principles of transportation and the principles of management to industrial activity. The traffic manager in the carrier organization; comparative advantages of different modes of transportation; selling the transportation service; government regulation of traffic management; use of tariffs; documentation; miscellaneous charges, rules and regulations. The industrial traffic manager, duties and qualifications; the industrial traffic management department; filing of claims, handling of freight; traffic management objectives.

(Prerequisite, T 1)

2½ semester hours credit

T 3 ADVANCED TRAFFIC MANAGEMENT PROBLEMS

This course applies the principles of transportation and the principles of traffic management to the solution of a series of actual and typical problems in industrial traffic management and carrier traffic management, and export and import procedure. The problems embody the application of the precepts of regulation and rate selection, as well as detailed analysis of comparative services and their costs.

(Prerequisites, T 1, 2)

2½ semester hours credit

T 4 SELLING TRANSPORTATION SERVICES

This course deals with the nature and function of transportation service as an item bought and sold; the various types of transportation service available; matching the proper service to the proper need; engineering the sale of transportation service as contrasted with the haphazard "solicitation of freight"; what the transportation salesman should know about service rates; legal and ethical restriction on selling transportation service; liaison between sales, office, and operations from a sales viewpoint; various methods of proof that transportation service is not intangible.

(Prerequisites, D 5, T 1)

2½ semester hours credit

T 5 OCEAN TRANSPORTATION

This course includes the principles and practices of ocean transportation of freight; common, contract and tramp carrier operations; methods of calculating and applying rates and charges in ocean transportation; cargo control; customs procedures; free zones; through movement from and to inland points; port authority operation and port development; legal aspects of ocean freight movement.

(Prerequisite, T 1)

2½ semester hours credit

T 6 AIR CARGO TRANSPORTATION

This course deals with the chronological development and scope of the air cargo industry including air mail, air freight, and air express. It considers the characteristics of aircraft as carriers; practical applications of the airlines' official tariffs; the competitive position of air cargo transportation in the over-all transportation system; legal aspects of air cargo transportation; the effects of air transportation on our economy.

(Prerequisite, T 1)

2½ semester hours credit

T 7 TRANSPORTATION INSURANCE

This course discusses the risks in the transportation industry for which insurance coverage offers protection. It includes the consideration of carrier risks such as public liability in the event of loss of life or personal injury, loss or damage to property, workmen's compensation carrier risks such as cargo protection while freight is in transit under common carrier liability coverage from the shipper point of view with respect to in-transit all-risk floater insurance rights and liabilities of carrier and shipper in the event of loss or damage; specially designed insurance coverages for unusual transportation conditions.

(Prerequisite, T 1)

2½ semester hours credit

T 8 CURRENT TRANSPORTATION PROBLEMS

Seminar course in the application of advanced transportation practices to specific requirements of industry; the development of optimum transportation cost control based upon the given conditions in selected case study firms; construction of an effective traffic department liaison of traffic department with other departments of the company; rate record systems for observation and analysis of current and past transportation costs; specific approaches for transportation cost reduction, such as reclassification, departures from class rates; private carrier operation; shipper and consignee co-operatives, etc.; reliable measurement of transportation cost against standard industrial cost yardsticks; correct measurement of reduction in transportation costs.

(Enrollment only by approval of Instructor or Dean)

2½ semester hours credit

T 9-10 INTERSTATE COMMERCE COMMISSION PRACTICE AND PROCEDURE

A course designed to acquaint management levels in the transportation industry and the industrial traffic departments of general industry with the responsibilities applicable to the regulation of transportation by the Federal Government; who must execute these responsibilities; the procedure by which they are carried out; history and content of Interstate Commerce Act and its impact upon all industrial activity; purpose and function of the Interstate Commerce Commission; training and preparation for the Interstate Commerce Commission Practitioners' Examination, including a study of important cases under the Commerce Clause of the Constitution; administrative law and procedure; ethics and general rules of practice.

(Prerequisite, T 1)

5 semester hours credit

T 11 MOTOR CARRIER OPERATIONS

Nature and characteristics of the motor carrier industry; types of motor carrier operations common, contract, private, as well as local and over-the-road; regulation under the Motor Carrier Act of 1935; internal organization and administration, traffic management, terminal and garage operation; problems of revenue and cost, capital structure and financial management, selection, financing, maintenance, and replacement of equipment; industrial relations, safety and insurance; freight loss and damage claim; accounting, taxation and cost allocation; tariffs and classification; sales and public relations; trade associations and carrier rate conferences.

(Prerequisite, T 1)

2½ semester hours credit

T 12 MOTOR CARRIER TRAFFIC MANAGEMENT

This course deals with the administrative direction of the motor carrier as contrasted with the operational direction; the traffic manager as buffer between the carrier and the Interstate Commerce Act; co-operation with the sales department in the protection of the carrier's competitive position; general and special promulgation of carrier rates; bureau action and independent action; development of carrier's gross revenue structure; the relationship of the traffic manager to carrier ownership; line and staff functions supervised by the traffic manager; liaison between traffic, sales and operations from the traffic viewpoint.
(Prerequisite, T 11)

2½ semester hours credit

T 13 FREIGHT CLAIMS FOR LOSS AND DAMAGE

This course presents the practical procedure as well as the legal basis for handling loss and damage claims, including the bill of lading as a contract, development of common carrier liability; duties of consignee and carrier with regard to acceptance of damaged freight; preparation, filing and prosecution of freight claims; statute of limitations; damages, usual and unusual, as well as direct and indirect.
(Prerequisites, T 1, 2)

2½ semester hours credit

T 14-15 RATES AND TARIFFS

Technical treatment of tariff construction and use; structure of rates; the general rate level; procedure of filing; deviations from published tariffs and schedules; classification, exceptions, commodity rates, miscellaneous departures; changes in tariffs and classifications; the economic aspects of transportation rates.
(Prerequisites, T 1, 9-10)

5 semester hours credit

T 16 COMMERCIAL WAREHOUSING

Commercial warehousing has become an important and integrated element in the transportation of freight. This course stresses the possibilities and procedures for reducing the over-all transportation and distribution costs while providing improved service through intelligent selection and utilization of commercial warehousing facilities. It includes types of commercial warehouses and the function of each; commercial warehouse receipts as a method of short-term industrial finance; commercial warehousing as a natural economic method of price stabilization and market control; the legal aspects of commercial warehousing.

2½ semester hours credit

T 17 ADVANCED TRANSPORTATION ECONOMICS

This course looks beyond the mechanics of traffic management toward the more complete professionalization of the transportation executive, including the part played by transportation in the production process and the marketing process; transportation and the division of labor; the effect of transportation rates on prices and on the location of industry; carrier rate structure; the philosophy of public utility regulation; lawfulness and unlawfulness of carrier rates.
(Prerequisites, Ec 1-2, T 1, 2)

2½ semester hours credit



Received by _____

Date _____

UNIVERSITY COLLEGE

360 HUNTINGTON AVENUE, BOSTON 15, Mass.

APPLICATION FOR ADMISSION

Mr.
Mrs

I (Print name in full) Miss _____

Date _____

(First)

(Middle)

(Last)

hereby apply for admission to University College for the program designated.

- | | |
|---|--|
| <input type="checkbox"/> Commercial or Industrial Accounting Associate Degree Certificate | <input type="checkbox"/> In Accounting |
| <input type="checkbox"/> Public Accounting (C.P.A.) | <input type="checkbox"/> In Management |
| <input type="checkbox"/> Cost Accounting | <input type="checkbox"/> Credit & Financial Management Institute |
| <input type="checkbox"/> Business Management | <input type="checkbox"/> Institute for Business & Professional Secretaries |
| <input type="checkbox"/> Credit and Financial Management | <input type="checkbox"/> Institute of Insurance |
| <input type="checkbox"/> Industrial Management | <input type="checkbox"/> Institute of Material Handling |
| <input type="checkbox"/> Insurance | <input type="checkbox"/> Institute of Retailing |
| <input type="checkbox"/> Marketing | <input type="checkbox"/> Institute of Traffic Management |
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| <input type="checkbox"/> Office Management | <input type="checkbox"/> Office Management Institute |
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| <input type="checkbox"/> Production Management | <input type="checkbox"/> Quality Control Institute |
| <input type="checkbox"/> Real Estate | <input type="checkbox"/> Real Estate Institute |
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| <input type="checkbox"/> Transportation and Traffic Management | |
| <input type="checkbox"/> Construction Technology | |
| <input type="checkbox"/> Industrial Technology | |
| <input type="checkbox"/> Manufacturing Technology | |
| <input type="checkbox"/> Surveying Technology | |
| <input type="checkbox"/> Liberal Arts and Management | |

B.S.
Degree

Single Courses only: ☐ (List each course) _____

Home address: Street _____

State _____

City _____

Telephone _____

(OVER)

checks, money orders, or drafts payable to Northeastern University. **This fee is not refundable.** This fee is included under the educational benefits of the G. I. Bill of Rights.

Date of birth..... Age..... yrs..... mos.
 Are you to take these courses under the G. I. Bill of Rights? ☐ Yes ☐ Single
 Name and address of parents or guardian if under 21 years of age ☐ No ☐ Married

I have attended, including other schools of the Northeastern University system, the following schools above grammar grade. List all junior and senior high schools, evening high schools, preparatory schools, colleges and universities (if attendance at a university, *designate school*).

NAME OF SCHOOL	LOCATION — CITY, STATE	Check Years Attended				Date Left	Date of Graduation	Degree if any
		1	2	3	4			

I request advanced standing credit for previous college work completed at (name of institution).....

For information relative to my character and general ability, I refer you to the following person who is not a student or relative:

Name..... Street.....

City..... State..... Occupation.....

I first learned of Northeastern University through.....

Following is the name and address of the person who recommended that I enter the School of Business.....

I am employed as indicated below.

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Offers full-time day curricula on the Co-operative Plan leading to the degrees of Bachelor of Arts and Bachelor of Science; part-time evening programs available leading to the degree of Bachelor of Arts.

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Offers full-time day curricula on the Co-operative Plan leading to the degree of Bachelor of Science in Education in preparation for teaching in elementary or secondary schools; part-time evening program also available in co-operation with the College of Liberal Arts.

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THE COLLEGE OF ENGINEERING

Offers full-time day curricula on the Co-operative Plan and part-time evening programs, both leading to the degree of Bachelor of Science in Engineering.

UNIVERSITY COLLEGE

Offers part-time evening programs of adult education designed especially to meet the needs of employed personnel and leading to the Bachelor of Science degree or to appropriate associate degrees.

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Offers part-time evening curricula in science and in engineering technology leading to the degrees of Associate in Science and Associate in Engineering.

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All Programs Are Open to Both Men and Women

For further information

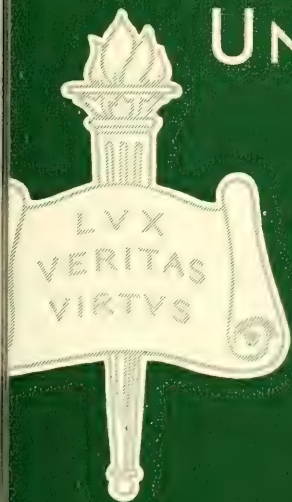
regarding any of the above schools or colleges, address

DR. GILBERT C. GARLAND, *Dean and Director of Admissions*

360 Huntington Avenue, Boston 15, Massachusetts, COpley 7-6600

Dedicated to the Advancement of Adult Learning
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NORTHEASTERN UNIVERSITY



BULLETIN
1960-1961

Lincoln Institute EVENING SESSIONS

BOSTON 15, MASSACHUSETTS

OFFICE HOURS

AUGUST 24, 1959 — JUNE 25, 1960

Monday — Friday 8:45 A.M.—9:00 P.M.
Saturdays 8:45 A.M.—12:00 NOON

JUNE 27, 1960 — AUGUST 20, 1960

Monday — Thursday 8:45 A.M.—8:30 P.M.
Friday 8:45 A.M.—5:00 P.M.

AUGUST 22, 1960 — JUNE 24, 1961

Monday — Friday 8:45 A.M.—8:30 P.M.
Saturdays 8:45 A.M.—12:00 NOON

INTERVIEWS

Prospective students, or those desiring advice or guidance regarding any part of the school work or curricula, are encouraged to arrange for personal interviews with the Dean or other officers of instruction. Career planning through competent guidance provides an understanding of professional requirements and develops that definiteness of purpose so vital to success.

Address communications to

DEAN DONALD H. MACKENZIE

LINCOLN INSTITUTE

NORTHEASTERN UNIVERSITY

360 Huntington Avenue, Boston 15, Massachusetts

Telephone COpley 7-6600

NORTHEASTERN UNIVERSITY

Lincoln Institute

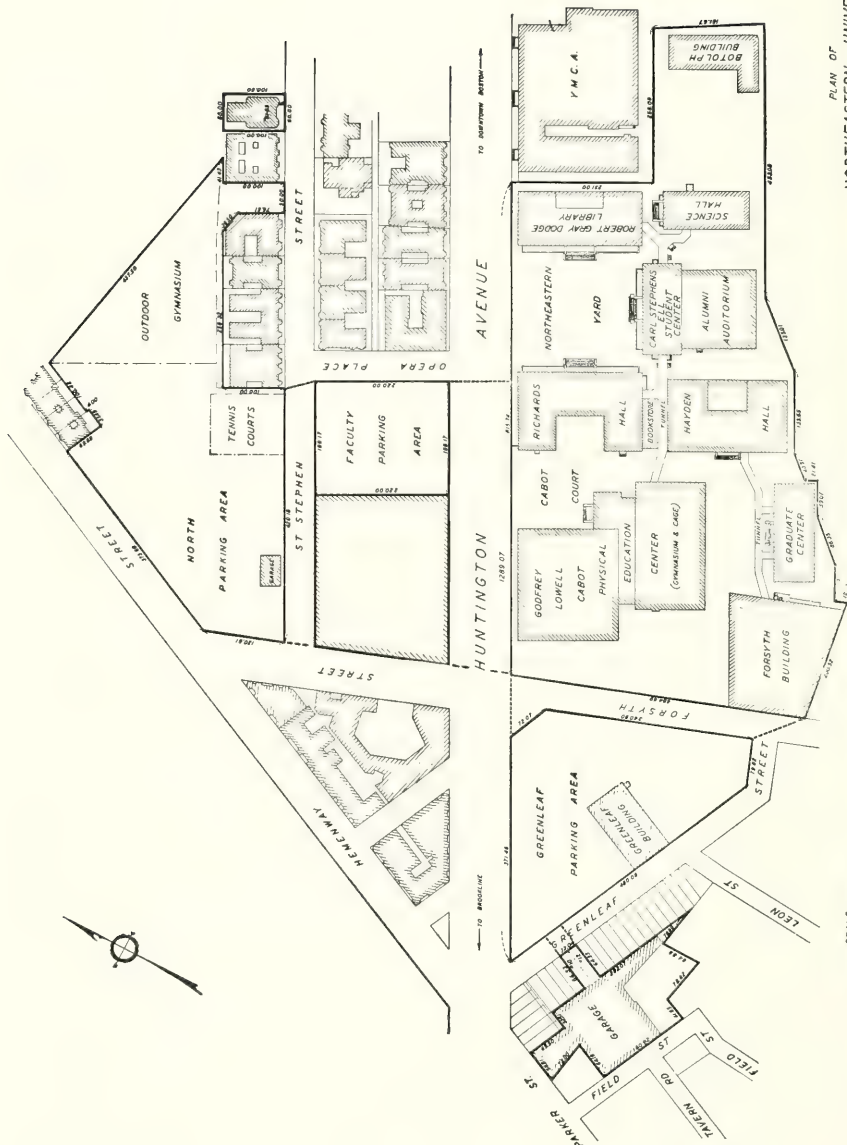
BULLETIN

1960-1961



Evening
Engineering Technology Courses
of College Grade

BOSTON 15, MASSACHUSETTS



CALENDAR

1960

Summer session classes begin	<i>June</i>	6
Commencement	<i>June</i>	19
Legal Holiday — No class sessions	<i>July</i>	4
Summer session classes end	<i>September</i>	1
Fall semester classes begin	<i>September</i>	19
Legal Holiday — No class sessions	<i>October</i>	12
Legal Holiday — No class sessions	<i>November</i>	11
Legal Holiday — No class sessions	<i>November</i>	24
Final class session before Christmas recess	<i>December</i>	19

1961

First class session after Christmas recess	<i>January</i>	3
Final examinations, fall semester	<i>January</i>	16-27
Division B and second semester classes begin	<i>January</i>	30
Legal Holiday — No class sessions	<i>February</i>	22
Legal Holiday — No class sessions	<i>April</i>	19
Final examinations, spring semester	<i>May</i>	15-24
Make-up Session for Wednesday classes	<i>May</i>	22
Legal Holiday — No class sessions	<i>May</i>	30
Summer session classes begin	<i>May</i>	31

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WILLIAM M. STEWART, B.S.

Manager of the Bookstore

RICHARD E. SPRAGUE, S.B., B.B.A., M.B.A., Ed.M.

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The instructional staff of the Lincoln Institute is composed of men who have an active interest in the welfare of ambitious evening school students. They are men of culture and high ideals and are well qualified by training and experience to teach in their respective fields.

(As of February 1, 1960)

GEORGE H. ANDERSON

Appointed 1956

Commercial Art Diploma, Vesper George School of Art, 1948; Professional Artist, Portraiture and Illustration; Marine Engineering Technician, Planning, Design Division, Boston Naval Shipyard.

Engineering Drawing

PAUL A. ANDREWS

Appointed 1959

B.A. Boston University, 1951; M.S. Northeastern University, 1957; Production Engineer, Microwave Associates, Inc.

General Chemistry

ROBERT B. ANGUS, JR.

Appointed 1948

B.S. Northeastern University, 1947; M.S. Harvard University, 1953; P.E. (Mass.); Section Head, Data Conversion Laboratory, Sylvania Electric Products, Inc.

Direct and Alternating-Current Theory

ROGER M. ANTOINE

Appointed 1955

Baccalaureat, Marseille University, 1942; Licence es-Science, Marseille University, 1945; Diploma of Meteorology, Marseille University, 1946; Diploma of Engineering, Marseille School of Engineering, 1946; Assistant Professor of Mathematics, Northeastern University.

Advanced Mathematics

ROBERT J. AVERILL

Appointed 1957

S.B. Northeastern University, 1957; M.S. Northeastern University, 1959; Cambridge Electron Accelerator, Harvard University.

Direct and Alternating-Current Machinery

RUSSELL H. BABCOCK

Appointed 1954

S.B. Tufts College, 1945; S.M. Harvard University, 1947; Diplomate, American Academy of Sanitary Engineers; P.E. (Mass., Maine, Vermont); Manager, Water and Waste Division, The Foxboro Co., Foxboro, Mass.

Water Supply, Sewerage and Sewage Disposal

RALPH E. BACH, JR.

Appointed 1956

B.S.E.E. Lehigh University, 1953; M.S. Northeastern University, 1957; Assistant Professor in Communications, Northeastern University.

Transients in Linear Systems

HOLLIS BAIRD

Appointed 1945

Assistant Professor of Physics, Northeastern University; Consulting Engineer, Radio and Television.

Communication Engineering

Chairman of the Department of Electronic Engineering

- JOHN C. BALSAVICH *Appointed 1957*
Massachusetts Radio School, 1956; Electronic Technician, Northeastern University.
Advanced Electronic Laboratory, Electronic Laboratory
- PAUL F. BARRETT *Appointed 1958*
B.S. University of New Hampshire, 1948; P.E. (New Hampshire); Structural Engineer, Jackson & Moreland, Inc.
Strength of Materials
- WILLIAM T. BARRY, JR. *Appointed 1956*
Massachusetts Institute of Technology, 1930-1932; Tax Accountant, Second Bank-State Street Trust Company.
Engineering Drawing
- EUGENE R. BARTLETT *Appointed 1958*
B.S.E.E. Northeastern University, 1957; M.S. Northeastern University, 1959; Research Associate, Electronics Research Project, Northeastern University.
Electronics for Industry Laboratory
- ROBERT T. BATEMAN *Appointed 1957*
B.S. University of New Hampshire, 1937; M.A. University of Maine, 1950; Head of Mathematics Department, Wellesley Senior High School.
Engineering Mathematics
- G. WARREN BATES *Appointed 1949*
B.S. Massachusetts Institute of Technology, 1926; M.A. Boston University, 1938; Instructor, Medford High School.
Pre-Engineering Mathematics, Engineering Mathematics
- ADOLPH BAUMANN *Appointed 1955*
B.S. Kantonales Technikum, Winterthur, Switzerland, 1940; Graduate Studies, Massachusetts Institute of Technology; Staff Engineer, Raytheon Company.
Communication Engineering
- STANLEY A. BEECOFF *Appointed 1957*
A.E. Lincoln Institute, 1957; Production Engineer, Baldwin-Lima-Hamilton Corp.
Electronic Laboratory
- WALTON B. BISHOP *Appointed 1959*
B.Ed. Illinois State Normal University, 1939; M.A. Boston University, 1950; M.S.E.E. Northeastern University, 1954; Electronics Research Engineer, Air Force Cambridge Research Center.
Pulse Circuits
- WILLIAM P. BLOTNICK *Appointed 1959*
S.B. Northeastern University, 1959; Graduate Assistant, Northeastern University.
Ac Machinery Laboratory
- EDWARD BOBROFF *Appointed 1946*
B.M.E. Polytechnic Institute of Brooklyn, New York, 1940; P.E. (Mass.); Electrical Engineer, Boston Naval Shipyard.
Advanced Mathematics
- FLETCHER S. BOIG *Appointed 1945*
B.S. Tufts College, 1932; M.S. Massachusetts Institute of Technology, 1933; Ed.M. Tufts College, 1937; Associate Professor of Chemistry, Northeastern University.
Chairman of the Department of Chemistry
General and Organic Chemistry Laboratory
- EDWARD J. BOOTH *Appointed 1956*
A.B. Boston College, 1933; Ed.M. Boston College Graduate School, 1937; Assistant Professor of Mathematics, Northeastern University.
Engineering Mathematics

- CHARLES H. BOUCHARD *Appointed 1957*
B.S. Worcester Polytechnic Institute, 1951; Sales Engineer, Westinghouse Electric Corporation.
Direct and Alternating-Current Theory
- KENNETH E. BOURQUE *Appointed 1959*
B.S. Northeastern University, 1958; Instructor in Electrical Engineering, Northeastern University.
Ac Machinery Laboratory
- JOHN P. BRADY, JR. *Appointed 1958*
S.B., M.S. Massachusetts Institute of Technology, 1953; P.E. (Mass.); Electronic Project Engineer, Sanborn Company.
Communication Engineering
- DONALD H. BRESLOW *Appointed 1959*
S.B. Brown University, 1954; M.S. Brown University, 1957; Senior Engineer, Avco Research Laboratory.
Electron Tubes and Circuits
- KARL L. BRIGGS *Appointed 1957*
B.S. Norwich University, 1924; M.A. Suffolk University, 1955; Head of Mathematics Department, Quincy High School.
Engineering Mathematics
- CURTIS C. BROOKS *Appointed 1937*
B.M.E. Northeastern University, 1924; A.M. Boston University, 1937; Retired.
Advanced Mathematics, Applied Mechanics
- FRANKLYN K. BROWN *Appointed 1955*
Lowell Institute, 1939; B.S.Ed. Northeastern University, 1959; Assistant Professor, Graphic Science, Northeastern University.
Engineering Drawing
- RICHARD B. BROWN, III *Appointed 1954*
S.B. Northeastern University, 1954; Systems Development Engineer, Sylvania Electric Products, Inc.
Advanced Electronic Laboratory
- WILLIAM O. BRUEHL *Appointed 1956*
B.S. University of Maryland, 1928; Ordnance Engineer, United States Army Ordnance Corps; Assistant Professor, Mechanical Engineering, Northeastern University.
Mechanical Engineering Laboratory
- MORRIS H. BURAKOFF *Appointed 1957*
S.B. University of Massachusetts, 1940; P.E. (Mass.); Senior Engineer, Western Electric Co., North Andover, Mass.
Electrical Measurements, Alternating-Current Theory
- GEORGE E. BURDICK *Appointed 1950*
A.B. Boston University, 1949; Section Head, Welding and Services, Raytheon Company.
Advanced Electronic Laboratory, Electronic Laboratory
- JOHN L. BURDICK *Appointed 1959*
B.S. Rensselaer Polytechnic Institute, 1947; S.M. Massachusetts Institute of Technology, 1948; P.E. (Mass. and N. Y.); Senior Engineer, Edwards & Kelcey.
Structural Design
- JAMES A. CAFFREY *Appointed 1952*
Ph.B. Boston College, 1922; M.Ed. Boston College, 1926; Instructor in Mathematics, Newman Preparatory School.
Pre-Engineering Mathematics, Engineering Mathematics

- FRANCIS J. CALLAHAN *Appointed 1948*
B.S. Northeastern University, 1948; Chief Engineer, Process Engineering, Inc.
Mechanical Engineering Laboratory
- ROBERT E. CAMERON *Appointed 1956*
B.S. Northeastern University, 1951; P.E. (Mass.); Personnel and Office Manager,
Harry R. Feldman, Inc., Engineers.
Surveying
- FRANK R. CANGIANO *Appointed 1957*
B.S. Boston University, 1957; Instructor in Science and Mathematics, Hobbs Junior
High School, Medford, Mass.
Pre-Engineering Mathematics
- MICHAEL A. CANGIANO *Appointed 1946*
S.B. Harvard University, 1933; Ed.M. Tufts College, 1949; Head of Science De-
partment and Junior Submaster, Medford High School.
Engineering Mathematics
Chairman of the Department of Engineering Mathematics
- RICHARD I. CARTER *Appointed 1950*
B.S. Northeastern University, 1952; M.S. Northeastern University, 1956; Assistant
Professor in Electrical Engineering, Northeastern University.
Transients in Linear Systems
- WALTER J. CASEY *Appointed 1955*
A.B. Boston College, 1951; M.Ed. Boston Teachers College, 1952; Instructor in
Mathematics, Boston Latin School.
Engineering Mathematics
- PHILIP J. CLANG *Appointed 1957*
B.S. University of Connecticut, 1950; P.E. (Mass.); Senior Engineer, Structural,
Jackson & Moreland, Inc., Engineers.
Strength of Materials
- LAURENCE FULLER CLEVELAND *Appointed 1931*
B.S. Worcester Polytechnic Institute, 1929; M.S. Massachusetts Institute of Tech-
nology, 1935; P.E. (Mass.); Associate Professor of Electrical Engineering, North-
eastern University.
Direct and Alternating-Current Machinery
Chairman of the Department of Electrical Engineering
- EDWARD V. CLOUGHERTY *Appointed 1956*
B.S. Boston College, 1952; A.M. Boston University, 1955; Research Staff, Manu-
facturing Laboratories, Inc., Research Division.
Physical Chemistry
- JEROME J. CONNOR, JR. *Appointed 1957*
S.B. Massachusetts Institute of Technology, 1953; S.M. Massachusetts Institute
of Technology, 1954; Sc.D. Massachusetts Institute of Technology, 1959; Structural
Engineer, Watertown Arsenal Laboratory.
Applied Mechanics
- ROGER T. CONNOR *Appointed 1953*
A.B. Boston College, 1952; M.Ed. State Teachers College, Boston, 1953; Mathe-
matics Instructor, Boston Technical High School.
Advanced Mathematics
- ROBERT J. CONNORS *Appointed 1947*
B.S. Northeastern University, 1948; Manager, Production Engineering, Data Sys-
tems Operation, Sylvania Electric Products, Inc.
Advanced Electronic Laboratory
- ALBERT L. COYNE *Appointed 1948*
B.S. University of Maine, 1915; Ed.M. Harvard University, 1937; P.E. (Mass.);
Instructor, Rindge Technical School.
Engineering Drawing

- OTIS F. CUSHMAN *Appointed 1937*
 B.S. University of New Hampshire, 1932; M.S. University of New Hampshire, 1934;
 Associate Professor of Graphic Science, Northeastern University.
Engineering Drawing
Chairman of the Department of Engineering Drawing
- WARREN C. DEAN *Appointed 1941*
 A.B. Boston University, 1931; M.A. Boston University, 1940; Associate Professor of
 Mathematics, Northeastern University.
Advanced Mathematics
Chairman of the Department of Advanced Mathematics
- J. JAMES DEVINE *Appointed 1939*
 B.S. University of Rhode Island, 1927; Sc.M. Brown University, 1936; P.E. (Mass.);
 Associate Professor of Graphic Science, Northeastern University.
Engineering Drawing
Assistant Chairman of the Department of Engineering Drawing
- JOHN F. DOBBYN *Appointed 1957*
 A.B. Harvard University, 1912; Ed.M. Harvard University, 1925; Master, Boston
 Latin School.
Pre-Engineering Mathematics, Engineering Mathematics
- JEREMIAH J. DONOVAN *Appointed 1957*
 A.B. Boston College, 1951; Ed.M. Boston State Teachers College, 1952; Assistant
 Professor, Boston State Teachers College.
Pre-Engineering Mathematics
- H. KENNETH DOOLEY *Appointed 1957*
 B.S. Boston College, 1951; Ed.M. Boston State Teachers College, 1953; Instructor
 in Mathematics, Braintree High School.
Pre-Engineering Mathematics
- HENRY B. EDEN *Appointed 1957*
 School of the Museum of Fine Arts, 1951; Art Director, Anco Technical Writing
 Services, Inc.
Engineering Drawing
- HERBERT E. ENGEL *Appointed 1958*
 B.S. College of the City of New York, 1949; Senior Member, Technical Staff, Radio
 Corporation of America.
Electron Tubes and Circuits
- CHARLES PHILIP ENGELHARDT, JR. *Appointed 1942*
 B.S. Harvard University, 1928; Master of Architecture, Harvard University, 1930;
 Architect, Kilham, Hopkins, Greeley & Brodie.
Machine Drawing
- HOWARD W. EVIRS, JR. *Appointed 1952*
 B.S. Northeastern University, 1951; P.E. (Mass.); Assistant Executive Engineer,
 Fitchburg Gas and Electric Light Company, Boston.
Direct and Alternating-Current Theory
Chairman of the Department of Direct and Alternating-Current Theory
- MARTIN J. FEENEY *Appointed 1957*
 B.S. Massachusetts Institute of Technology, 1931; Ed.M. Boston State Teachers
 College, 1938; Principal, Prince District, Boston Public Schools.
Pre-Engineering Mathematics, Engineering Mathematics
- WILLIAM D. FINAN *Appointed 1946*
 A.B. Boston College, 1938; M.A. Columbia University, 1941; Instructor in English
 and Mathematics, Weeks Junior High School, Newton.
Pre-Engineering Mathematics

- LOUIS A. FIORE *Appointed 1956*
A.E. Lincoln Technical Institute, 1944; B.B.A. Northeastern University, 1946; Chief Draftsman, Gabriel Electronics Company.
Engineering Drawing
- EARLWOOD T. FORTINI *Appointed 1957*
Lowell Institute School, 1947; Mechanical Engineer, Photon, Inc.
Machine Design
- ARTHUR R. FOSTER *Appointed 1949*
B.S. Tufts College, 1945; M.E. Yale University, 1949; P.E. (Mass.); Associate Professor of Mechanical Engineering, Northeastern University.
Mechanical Engineering Laboratory
- ARTHUR P. FREDERICKSEN *Appointed 1957*
Lincoln Institute; Industrial Engineer, Shoe Engineering Dept., United Shoe Machinery Corp.
Engineering Drawing
- JOHN L. FREEDMAN *Appointed 1949*
S.B. Massachusetts Institute of Technology, 1932; P.E. (Mass.); Project Engineer, R. C. A. Airborne Systems Laboratory.
Electron Tubes and Circuits, Electronic Laboratory
Chairman of the Department of Electron Tubes and Circuits
- ROYAL MERRILL FRYE *Appointed 1930*
A.B. 1911; A.M. 1912; Ph.D. 1934, Boston University; Dean, College of Advanced Science; Graduate Division, Northeastern University.
Physics
- CHARLES A. FURCINITI *Appointed 1957*
S.B. Northeastern University, 1957; M.S. Northeastern University, 1959; Engineer, Raytheon Company.
Direct and Alternating-Current Theory
- BRONISLAUS J. GEDREWICZ *Appointed 1956*
S.B. Massachusetts Institute of Technology, 1931; Designer, Small Aircraft Engine Department, General Electric Company.
Engineering Drawing
- HARRY GILDEA *Appointed 1959*
S.B. Massachusetts Institute of Technology, 1957; S.M. Massachusetts Institute of Technology, 1958; Engineer, Sylvania Electric Products.
Semiconductors and Transistors
- ARTHUR GLAZER *Appointed 1959*
S.B. Northeastern University, 1958; Instructor in Electrical Engineering, Northeastern University.
Ac Machinery Laboratory
- ALVIN L. GLICK *Appointed 1958*
B.S. Polytechnic Institute of Brooklyn, 1953; M.S. Rutgers University, 1955; Engineer, Raytheon Company.
Semiconductors and Transistors, Electronic Physics
- ROBERT GRISWOLD *Appointed 1956*
B.S. New Bedford Institute of Technology, 1954; M.S. Northeastern University, 1956; Graduate Student, Massachusetts Institute of Technology.
Qualitative and Quantitative Chemistry
- LAWRENCE A. HAINES *Appointed 1956*
A.E. Lincoln Technical Institute, 1953; Sales Engineer, Mason-Neilan Division, Worthington Corporation.
Engineering Drawing

- JOSEPH L. HALLETT, JR. *Appointed 1958*
S.B. Northeastern University, 1955; Senior Electronics Engineer, Sylvania Electric Products.
Electronic Laboratory
- FRANK A. HAMILTON *Appointed 1947*
A.E. Lincoln Technical Institute, 1939; Structural Engineer, Jackson & Moreland, Inc.
Structural Drawing
- ALDEN G. HANDY *Appointed 1957*
B.S. Boston University, 1924; M.A. Boston University, 1936; Consultant, Optics.
Physics
- FRANCIS R. HANKARD *Appointed 1946*
S.B. Northeastern University, 1946; M.A. Boston University, 1949; Chemist, State Police Laboratories.
Physics
- HARRY N. HARDSOG *Appointed 1958*
B.S., M.S. Massachusetts Institute of Technology, 1929; P.E. (Mass.); Assistant Professor of Physics, Northeastern University.
Physics
- ROBERT L. HARRINGTON *Appointed 1948*
B.M.E. Clarkson College of Technology, 1939; M.S. Case Institute, 1941; P.E. (Mass.); Associate Professor of Mechanical Engineering, Tufts University.
Heat Engineering
- ERIC HARRISON *Appointed 1949*
Wentworth Institute, 1920; B.S. Suffolk University, 1937; M.A. Suffolk University, 1951; Instructor in Mechanical Drawing, Medford High School.
Engineering Drawing
- HOLLIS D. HATCH *Appointed 1956*
A.B. Harvard College, 1915; Ed.M. Boston Teachers College, 1937; Lecturer in Physics, Northeastern University.
Physics
- PERCY H. HILL *Appointed 1950*
B.M.E. Rensselaer Polytechnic Institute, 1944; M.S. Harvard University, 1951; P.E. (Mass.); Associate Professor in Engineering, Tufts University.
Mechanism
- ROBERT EDGAR HODGDON *Appointed 1927*
B.S. University of New Hampshire, 1917; M.S. Massachusetts Institute of Technology, 1931; Instructor, Rindge Technical School.
Physics
- ERHARD J. HOFMANN *Appointed 1956*
B.E.E. 1954, Polytechnic Institute of Brooklyn; Staff Engineer, Lincoln Laboratory, Massachusetts Institute of Technology.
Direct and Alternate-Current Theory, Electronic Laboratory
- WHEATON A. HOLDEN *Appointed 1955*
A.B. Brown University, 1948; M.A. Boston University, 1949; Assistant Professor, Northeastern University.
Engineering Drawing
- RICHARD W. HUBBARD *Appointed 1957*
B.S. University of Massachusetts, 1935; Ed.M. Harvard University, 1945; Graduate School, Northeastern University; Head of Mathematics Department, Weeks Junior High School, Newton, Mass.
Pre-Engineering Mathematics

- EVERETT L. HUME *Appointed 1950*
B.S. 1933, M.S. 1933, Massachusetts Institute of Technology; P.E. (Mass.); Engineer, Jackson & Moreland, Inc.
Hydraulics
- MARTIN IDELSON *Appointed 1956*
B.S.Ch. Polytechnic Institute of Brooklyn, 1952; Ph.D. Polytechnic Institute of Brooklyn, 1955; Scientist, Polaroid Corporation.
Organic Chemistry
- CARROLL I. JOHNSON *Appointed 1956*
S.B. Massachusetts Institute of Technology, 1950; M.S. Northeastern University, 1958; P.E. (Mass. & Wash.); Plant Manager, Emerson & Cuming, Inc.
Applied Mechanics
- PERCY E. JONES *Appointed 1923*
B.S. Boston University, 1930; Instructor in Mathematics, Huntington School.
Pre-Engineering Mathematics
- A. LOUIS KARP *Appointed 1956*
A.B. Harvard College, 1927; Ed.M. Boston University, 1931; Submaster, Boston School Department.
Pre-Engineering Mathematics, Engineering Mathematics
- LOUIS KATONA *Appointed 1959*
B.C.E. College of the City of New York, 1944; M.C.E. Polytechnic Institute of Brooklyn, 1948; P.E. (Mass. and N. Y.); Hydraulic and Sanitary Engineer, Barnes and Jarnis, Inc.
Hydraulics
- CHARLES W. KAUFMAN *Appointed 1958*
B.S. Bridgewater Teachers College, 1939; Ed.M. Boston University, 1940; Science Teacher, Brighton High School.
Physics
- JOHN T. KEIRAN *Appointed 1957*
A.B. Boston College, 1933; A.M. Harvard University, 1935; Master, Boston Latin School.
Engineering Mathematics
- BERNARD J. KILEY *Appointed 1958*
B.E. 1953, M.E. 1954, Yale University; Structural Designer, Clarkeson Engineering Company, Inc.
Applied Mechanics
- MARK M. KILEY *Appointed 1955*
B.E. Yale University, 1948; M.E. Yale University, 1949; P.E. (Mass., R. I.); Consulting Engineer.
Strength of Materials
- WILLIAM F. KING *Appointed 1957*
B.S. Northeastern University, 1957; M.S. Northeastern University, 1959; Engineer, Minneapolis-Honeywell, Boston Division.
Advanced Electronic Laboratory, Direct-Current Theory
- JOHN J. KLEIN *Appointed 1950*
B.S. Northeastern University, 1949; M.S. Northeastern University, 1955; Leader (Advanced Circuit Development), Missile Electronics and Control Department, Radio Corporation of America.
Direct and Alternating-Current Machinery Laboratory.
- BORAH L. KREIMER *Appointed 1954*
B.S. North Carolina State College, 1940; Ed.M. Northeastern University, 1956; Assistant Professor of Graphic Science, Northeastern University.
Engineering Drawing

- HORATIO W. LAMSON** *Appointed 1945*
B.S. Massachusetts Institute of Technology, 1915; M.A. Harvard University, 1917; P.E. (Mass.); Research Engineer, Emeritus, General Radio Company.
Alternating-Current Theory, Electrical Measurements
- HERBERT C. LANG** *Appointed 1936*
B.S. Northeastern University, 1934; P.E. (Mass.); Chief Draftsman, Mason-Neilan Division of Worthington Corporation.
Machine Drawing
Chairman of the Department of Machine Drawing
- ROBERT S. LANG** *Appointed 1955*
B.S. Northeastern University, 1945; Ed.M. Boston University, 1954; Assistant Professor of Graphic Science, Northeastern University.
Engineering Drawing
- CLARENCE E. LEBELL** *Appointed 1955*
Lowell Institute, 1940; Mechanical and Electrical Engineering Designer, Aircraft Gas Turbine Division, General Electric Co.
Engineering Drawing
- JOHN ROBERT LEIGHTON** *Appointed 1915*
B.C.E. Northeastern University, 1914; Senior Instructor of Strength of Materials, Wentworth Institute.
Applied Mechanics, Strength of Materials
Chairman of Department of Applied Mechanics and Strength of Materials
- NICHOLAS J. LEMBO** *Appointed 1953*
B.S. Boston College, 1951; Ed.M. Boston Teachers College, 1952; Assistant Professor of Physical Science, State Teachers College at Boston.
Pre-Engineering Mathematics, Engineering Mathematics
- HOWARD LESSOFF** *Appointed 1957*
S.B. 1953, M.S. 1957, Northeastern University; Staff Engineer, Radio Corporation of America.
Qualitative-Quantitative Chemistry Laboratory
- CHARLES S. LEWIS** *Appointed 1956*
S.B. Colby College, 1924; Ed.M. Harvard University, 1926; Head of Science Department, Roslindale High School.
Physics
- DEMETRE P. LIGOR** *Appointed 1959*
B.S. Massachusetts Institute of Technology, 1949; Supervisor, Instrumentation Manufacturing, Baldwin-Lima-Hamilton Corp.
Electronic Physics, Semiconductors and Transistors
- JOHN W. F. LLOYD** *Appointed 1959*
B.S. Northeastern University, 1958; Instructor in Electrical Engineering, Northeastern University.
Electronics for Industry Laboratory
- EDWARD F. LOBACZ** *Appointed 1951*
B.S.C.E. Northeastern University, 1943; M.S.C.E. Harvard University, 1948; P.E. (Mass.); Supervisory Civil Engineer, (S.M.) U. S. Army Engineer Division, New England.
Structural Analysis
- ANDREW G. LOFGREN** *Appointed 1946*
Lowell Institute, 1932; A.A. Harvard University, 1942; Ed.M. Boston University, 1946; Master, Mechanical Drawing, Boston Technical High School.
Engineering Drawing
- BERTRAM S. LONG** *Appointed 1952*
B.S. Northeastern University, 1949; M.S. Northeastern University, 1954; Assistant Professor of Mechanical Engineering, Northeastern University.
Mechanical Engineering Laboratory

- ROGER G. LONG *Appointed 1952*
A.E. Lincoln Technical Institute, 1950; Graduate Study, Harvard University, 1950-51; B.B.A. Northeastern University, 1953; Chief Engineer, General Communication Company.
Advanced Electronic Laboratory
- KENNETH A. LUCAS *Appointed 1950*
S.B. Massachusetts Institute of Technology, 1925; M.Ed. Boston University, 1931; P.E. (Mass.); Reg. Land Surveyor (Mass.); Civil Engineer, Whitman & Howard, Inc.
Surveying
- JOHN F. LUTKEVICH *Appointed 1956*
A.E. Lincoln Technical Institute, 1952; B.B.A. Northeastern University, 1954; Engineer, Sylvania Electric Products, Inc.
Machine Drawing, Engineering Drawing
- ALEXANDER MACMULLEN *Appointed 1956*
B.S. Massachusetts Institute of Technology, 1951; M.S. Massachusetts Institute of Technology, 1951; Section Manager, Raytheon Company.
Electronic Physics, Electronic Laboratory
- ALVIN MANDELL *Appointed 1950*
B.E.E. College of the City of New York, 1943; P.E. (Mass.); M.S. Northeastern University, 1955; Supervisor, Boeing Airplane Company.
Advanced Electronic Laboratory
- ARTHUR J. MARCHAND, JR. *Appointed 1955*
S.B. 1955, M.S. 1958, Northeastern University; Engineer, Bethlehem Steel Company.
Mechanical Engineering Laboratory
- PASQUALE A. MARINO *Appointed 1959*
B.S. Northeastern University, 1956; P.E. (Mass.); Instructor in Mechanical Engineering, Northeastern University.
Heat Engineering
- ALEXANDER G. MARSHALL, JR. *Appointed 1957*
A.B. Middlebury College, 1951; M.A. Boston University, 1954; Mathematics Instructor, Lincoln-Sudbury Regional High School.
Engineering Mathematics
- R. PAUL MASTROCOLA *Appointed 1957*
S.B. Northeastern University, 1957; Mechanical Engineer, Raytheon Company.
Mechanical Engineering Laboratory
- JOHN D. MAZGELIS *Appointed 1957*
Industrial Technical Institute, 1956; Customer Engineer, International Business Machines Corp.
Electronic Laboratory
- FRANCIS T. McCABE *Appointed 1952*
B.S. University of Maine, 1917; Ed.M. Harvard University, 1928; Formerly Headmaster, Rindge Technical School.
Engineering Drawing
- EDWARD F. MCCARREN, JR. *Appointed 1951*
A.E.E. Lincoln Technical Institute, 1951; Engineering Assistant, Baldwin-Lima-Hamilton Corp.
Advanced Electronic Laboratory
- VERNON S. MCFARLIN *Appointed 1953*
B.E.E. Northeastern University, 1931; P.E. (Mass.); Supervising Engineer, Boston Edison Company.
Engineering Mathematics

- EUGENE L. McLAUGHLIN *Appointed 1956*
A.B. Boston College, 1929; M.A. Boston College Graduate School, 1931; Head of Mathematics Department, Hyde Park High School.
Engineering Mathematics
- ROBERT F. McMAHON *Appointed 1956*
B.S. University of Maine, 1953; M.S. Harvard University, 1954; Technical Service Manager, Keleket X-Ray Division, Tracerlab, Inc.
Engineering Mathematics
- ROBERT L. MESERVE *Appointed 1954*
S.B. Northeastern University, 1951; L.S. (Mass.); Project Engineer, Camp, Dresser & McKee.
Surveying
- CARL MILLER *Appointed 1945*
A.B. Harvard University, 1929; LL.B. Boston University, 1933; Ed.M. Boston Teachers College, 1935; Assistant Principal, Boston School Department.
Engineering Mathematics, Pre-Engineering Mathematics
Chairman of Department of Pre-Engineering Mathematics
- KNOWLTON MILLER *Appointed 1958*
A.B. Harvard University, 1958; Engineer, Radio Corporation of America.
Electron Tubes and Circuits
- RICHARD W. MILLER *Appointed 1959*
B.S. Northeastern University, 1958; Engineering Trainee, Threadwell Tap & Die Company.
Mechanical Engineering Laboratory
- ERNEST E. MILLS *Appointed 1947*
B.S. Northeastern University, 1946; M.S. Northeastern University, 1954; Assistant Professor of Mechanical Engineering, Northeastern University.
Mechanical Engineering Laboratory
- ROBERT L. MOYNIHAN *Appointed 1959*
B.S. Northeastern University, 1959; Graduate Assistant, Electrical Engineering Department, Northeastern University.
Advanced Electronic Laboratory
- JULIAN S. NATANSON *Appointed 1957*
Franklin Technical Institute, 1937-1941; Lowell Institute, 1943; Research and Development Department, Keystone Manufacturing Co.
Machine Drawing
- JOHN R. O'BRIEN *Appointed 1946*
A.B. Boston College, 1933; A.M. Boston College, 1934; Head of Mathematics Dept., English High School, Boston.
Advanced Mathematics
- RALPH W. O'ROURKE *Appointed 1953*
B.S.E. Fitchburg State Teachers College, 1936; M.S. University of Massachusetts, 1938; Instructor in Engineering Drawing and Industrial Management, Apprentice School, Boston Naval Shipyard.
Engineering Drawing
- JOHN N. OSTIS *Appointed 1955*
A.E. Lincoln Institute, 1953; B.B.A. in E. & M., Northeastern University, 1954; Staff Engineer, Mitre Corporation.
Advanced Electronic Laboratory
- THOMAS J. OWENS *Appointed 1952*
A.B. Boston College, 1943; Instructor in Mathematics, Quincy High School.
Advanced Mathematics
- WILLIAM E. PALMQUIST *Appointed 1958*
B.S. Illinois Institute of Technology, 1955; First Lieutenant, U.S.A.F., Air Force Cambridge Research Center.
Applied Mechanics

- NORMAND A. PAQUETTE *Appointed 1958*
A.E. Lincoln Institute, 1956; B.B.A. Northeastern University, 1958; Research Engineer, Melpar, Inc.
Electronic Laboratory
- WILLIAM M. PARKER *Appointed 1957*
L.L.B. Northeastern University, 1925; A.E. Lincoln Institute, 1956; Mechanical Engineer, Minneapolis-Honeywell Regulator Co., Boston Division.
Engineering Mathematics
- WILLIAM H. PARMENTER *Appointed 1952*
A.E. Lincoln Technical Institute, 1948; B.B.A. Northeastern University, 1952; Engineer, Baird-Atomic Inc.
Advanced Electronic Laboratory
- DONALD PATERSON *Appointed 1959*
S.B. Northeastern University, 1958; Teaching Fellow, Northeastern University.
Mechanical Engineering Laboratory
- KENNETH C. PERKINS *Appointed 1955*
S.B. Northeastern University, 1951; S.M. Massachusetts Institute of Technology, 1953; Senior Engineer, Hampshire Engineering Company.
Direct and Alternating-Current Theory
- BERNARD D. PERRY *Appointed 1959*
B.E.E. Rensselaer Polytechnic Institute, 1952; M.S. Northeastern University, 1956; Electronic Development Engineer, Laboratory for Electronics.
Electron Tubes and Circuits
- CHAUNCY S. PERRY *Appointed 1957*
B.S. Northeastern University, 1957; M.S. Northeastern University, 1959; Assistant Project Engineer, Raytheon Company.
Mechanical Engineering Laboratory
- ROBERT F. PIERCE *Appointed 1956*
B.S. Northeastern University, 1947; Ed.M. Boston University, 1953; Chairman of Mathematics Department, Westwood High School.
Advanced Mathematics
- SIDNEY F. QUINT *Appointed 1954*
S.B. Northeastern University, 1946; S.M. Massachusetts Institute of Technology, 1950; P.E. (Mass.); Development Engineer and Group Leader, Raytheon Company.
Electron Tubes and Circuits
- GERARD H. RATCLIFFE *Appointed 1955*
A.B. Boston University, 1949; Senior Engineer, Sylvania Electric Products, Inc.
Advanced Electronic Laboratory
- RICHARD S. RICE *Appointed 1951*
S.B. Thayer School of Civil Engineering, Dartmouth College, 1943; M.S. Massachusetts Institute of Technology, 1947; P.E. (Mass.); Structural Engineer, Jackson & Moreland, Inc., Engineers.
Concrete Design
- EDWARD L. RICH *Appointed 1956*
B.S. Northeastern University, 1952; M.S. Northeastern University, 1956; Project Engineer, Sylvania Electric Products, Inc.
Heat Engineering, Strength of Materials
- DAVID E. ROSENGARD *Appointed 1946*
A.B. Harvard College, 1931; A.M. Harvard University, 1932; Head of Mathematics Department, Girls Latin School, Boston.
Advanced Mathematics
- BARNET RUDMAN *Appointed 1942*
A.B. Harvard University, 1921; Ed.M. Boston Teachers College, 1934; Assistant Professor of Mathematics, Northeastern University.
Advanced Mathematics

- WILFRED P. RULE *Appointed 1957*
S.B. Tufts University, 1953; M.S. Massachusetts Institute of Technology, 1957;
Assistant Professor of Engineering Graphics, Tufts University.
Mechanism
- RICHARD M. RUSH *Appointed 1956*
S.B. United States Naval Academy, 1918; M.S. Massachusetts Institute of Technology, 1922; Associate Professor of Physics, Northeastern University.
Physics
- ALBERT E. SANDERSON *Appointed 1936*
B.C.E. Northeastern University, 1926; B.S. Northeastern University, 1940; M.S. Harvard University, 1944; P.E. (Mass.); Associate Professor of Civil Engineering, Northeastern University.
Structural Design
- FRANK W. SARNOW, JR. *Appointed 1948*
B.S. 1939, B.B.A. 1954, Ed.M. 1958, Northeastern University; P.E. (Mass.); Deputy Chief, Plant Facilities Office, Watertown Arsenal.
Structural Drawing
- FRANCIS SATTIN *Appointed 1959*
S.B. Northeastern University, 1943; P.E. (Mass.); Structural Design Engineer, Badger Manufacturing Company.
Strength of Materials
- HENRY SCHWARTZ *Appointed 1958*
A.B. University of California, 1939; M.Ed. Teachers College, North Adams, 1944; P.E. (Mass.); Field Engineer.
Physics
- SEYMOUR SCHWARTZ *Appointed 1959*
B.S. Harvard University, 1948; President and Director of Engineering, Transistor Application, Inc.
Semiconductors and Transistors
- CHARLES F. SEAVERN *Appointed 1941*
Harvard University, 1915-17; Associate in Engineering, Lincoln Institute, 1944; Graduate work in Education, Boston University, 1945-47; Retired.
Engineering Drawing
- HAROLD M. SHARAF *Appointed 1955*
B.S., M.S. Massachusetts Institute of Technology, 1952; Vice-President, Tenco Electronics, Inc.
Communication Engineering
- FREEMAN D. SHEPHERD, JR. *Appointed 1959*
B.S. Massachusetts Institute of Technology, 1959; Electronic Research Specialist, Air Force Cambridge Research Center.
Electronic Physics, Semiconductors and Transistors
- JOSEPH SIMONS *Appointed 1956*
B.S. Boston University, 1950; M.Ed. Boston University, 1953; Supervisor of Apprentice Training, Boston Naval Shipyard.
Advanced Mathematics
- GORDON N. SMITH *Appointed 1957*
B.S. Massachusetts Institute of Technology, 1954; P.E. (R. I.); Chief Engineer, Monitor and Control Division, Fenwal Corporation.
Communication Engineering
- ERNEST L. SPENCER *Appointed 1941*
B.S. Northeastern University, 1936; M.S. Harvard University, 1943; P.E. (Mass.); R.L.S. (Mass.); Associate Professor of Civil Engineering, Northeastern University.
Chairman of the Department of Civil Engineering
Structural Analysis
- S. LEONARD SPITZ *Appointed 1955*
B.S. Northeastern University, 1946; P.E. (Mass.); Project Engineer, Allied Research Associates.
Heat Engineering

- FREDERICK ARLINGTON STEARNS** *Appointed 1921*
B.S. 1917, M.S. 1934, Massachusetts Institute of Technology; P.E. (Mass.); Professor of Mechanical Engineering, Northeastern University.
Heat Engineering
Chairman of the Department of Mechanical Engineering
- ROBERT B. STITT** *Appointed 1959*
B.B.A. Northeastern University, 1959; Senior Engineer, Edgerton, Germeshausen & Grier, Inc.
Electronic Laboratory
- MAURICE TEMPLE** *Appointed 1956*
S.B. Northeastern University, 1947; M.Ed. Boston Teachers College, 1952; Senior Instructor in Science, Boston Public Schools.
Pre-Engineering Mathematics, Engineering Mathematics
- ROBERT L. THING** *Appointed 1957*
B.S. 1943, M.S. 1951, University of Illinois; Development Engineer, Mason-Neilan Division, Worthington Corporation.
Electron Tubes and Circuits
- FRANK E. TRUESDALE** *Appointed 1957*
B.S. University of Massachusetts, 1950; Assistant Professor in Graphic Science, Northeastern University.
Engineering Drawing
- FRANK A. UNDERWOOD** *Appointed 1959*
S.B. Northeastern University, 1958; Junior Engineer, Microtech Research Co.
Mechanical Engineering Laboratory
- ARTHUR M. VUILLEUMIER** *Appointed 1953*
Instructor in Electronics, Massachusetts Trade School; Project Engineer, L. M. Herman Company, R. C. A. Sound Division Section.
Advanced Electronic Laboratory
- RICHARD WADLER** *Appointed 1953*
A.M.E. Lincoln Technical Institute, 1947; P.E. (Mass.); Senior Engineer, Raytheon Company.
Machine Design
- WILLIAM E. WALKER, JR.** *Appointed 1958*
B.S. University of Massachusetts, 1956; M.S. Northeastern University, 1959; Engineer, Camp, Dresser & McKee.
Hydraulics
- THOMAS H. WALLACE** *Appointed 1941*
S.B. Boston University, 1933; M.A. Harvard Graduate School, 1936; Ph.D. Boston University, 1939; Associate Professor of Physics, Northeastern University.
Physics
Chairman of the Department of Physics
- JOHN E. WALSH** *Appointed 1947*
A.B. St. Michael's College, 1938; A.M. Boston University, 1940; Head, Advanced Antenna Research Section, Pickard & Burns, Inc.
Advanced Mathematics
- JOHN L. WARNER** *Appointed 1948*
B.S. Tufts College, 1942; M.S. Harvard University, 1950; Associate Professor of Electrical Engineering, Tufts University.
Transmission Line Theory, Electronics for Industry
- GEORGE E. WASHBURN** *Appointed 1957*
S.B. Massachusetts Institute of Technology, 1909; Ph.D. University of Berlin, 1914; Retired.
Physics

- CHARLES I. WATERMAN** *Appointed 1956*
 B.S.E.E. Northeastern University, 1947; M.S.E.E. Harvard University Graduate School of Engineering, 1948; P.E. (Mass.); Senior Engineer, Bay State Electronics Corp.
Direct and Alternating-Current Theory
- FRANK S. WEINERT** *Appointed 1957*
 A.B. Harvard College, 1948; B.S. Columbia University, 1951; M.S. Columbia University, 1952; Optometrist.
Engineering Mathematics
- MORTON D. WEINERT** *Appointed 1955*
 A.B. Harvard University, 1938; Ed.M. Boston Teachers College, 1939; Mathematics Master, Boston Latin School.
Advanced Mathematics
- GEORGE B. WELCH** *Appointed 1946*
 B.S. Bowdoin College, 1922; Ph.D. Cornell University, 1928; Professor of Physics, Northeastern University.
Electronic Physics, Semiconductors and Transistors
- RALPH A. WELLINGS** *Appointed 1955*
 B.S. Boston College, 1955; Mathematics Instructor, Boston Public Schools.
Engineering Mathematics
- RALPH E. WELLINGS** *Appointed 1944*
 A.B. Boston College, 1920; A.M. Boston College, 1925; Ed.M. Boston Teachers College, 1930; Head of Science Department, Brighton High School.
Physics
- KARL H. WEST, JR.** *Appointed 1956*
 B.S. Northeastern University, 1950; M.Ed. Boston Teachers College, 1951; Instructor in Mathematics, Needham High School.
Engineering Mathematics
- THOMAS F. WHITE** *Appointed 1957*
 B.S. Mathematics, Boston College, 1951; B.S. Massachusetts Maritime Academy, 1952; M.Ed. Bridgewater State Teachers College, 1952; Instructor of Mathematics, Quincy High School.
Engineering Mathematics
- WILLARD B. WHITTEMORE** *Appointed 1957*
 B.S. in C.E. Massachusetts Institute of Technology, 1932; Ed.M. Boston University, 1946; C.A.G.S. Boston University, 1956; Instructor in Mathematics, Everett High School.
Pre-Engineering Mathematics
- JOSEPH F. WILLARD** *Appointed 1949*
 S.B. Northeastern University, 1949; P.E. (Mass.); Assistant Civil Engineer, Electronic Computer Development, Massachusetts Department of Public Works.
Transportation Engineering
- ALBERT G. WILSON, JR.** *Appointed 1948*
 B.S. in Civil Engineering, Thayer School, Dartmouth, 1946; M.S. Case Institute of Technology, 1948; P.E. (Mass.); Structural Engineer, Anderson-Nichols Co.
Applied Mechanics
- ROBERT D. WRIGHT** *Appointed 1955*
 A.E. Lincoln Institute, 1955; Graduate Study, Northeastern University; Senior Engineer, Data Systems Operations, Sylvania Electric Products, Inc.
Electron Tubes and Circuits, Advanced Electronic Laboratory
- JOSEPH W. ZELLER** *Appointed 1950*
 B.S. 1908, M.E. 1938, Tufts University; P.E. (Mass.); Professor Emeritus of Mechanical Engineering, Northeastern University.
Machine Design

NORTHEASTERN UNIVERSITY

AIMS AND SCOPE OF THE UNIVERSITY

Founded in 1898, Northeastern University is incorporated as a privately endowed non-sectarian institution of higher learning under the General Laws of Massachusetts. The State Legislature by special enactment has given the University general degree granting powers. The University is governed by a Board of Trustees who are elected by and from the Northeastern University Corporation which is comprised of more than a hundred distinguished business and professional men.

From its beginning Northeastern University has had as its dominant purpose the discovery of community educational needs and the meeting of these in distinctive and serviceable ways. The University has not duplicated the programs of other institutions, but has sought to pioneer new areas of educational service.

A distinctive feature of Northeastern University is its Co-operative Plan, initiated by the College of Engineering in 1909 and subsequently adopted by the Colleges of Business Administration (1922), Liberal Arts (1935), and Education (1953). This serviceable educational method enables students to gain valuable practical experience as an integral part of their college programs and also provides the means by which they may contribute substantially to the costs of their education. The plan has been extended to the graduate level in several fields of engineering in co-operation with industrial corporations located throughout the United States.

In the field of adult education, programs of study have been developed to meet a variety of needs. Since 1906 evening curricula have been offered leading to the bachelor's degree in business and carefully planned to serve mature students who are employed full time during the day but who are desirous of broadening their educational background by part-time study. Similar evening programs in the arts and sciences, in engineering, and in teacher education have been added in recent years. All formal courses of study leading to degrees through evening programs are approved by the appropriate college faculty and are subject to the same quantitative and qualitative standards as the regular day curricula.

The following is a brief outline of the aims and scope of the University's programs.

I. The Five Colleges

1. *The College of Liberal Arts*

The College of Liberal Arts offers majors in the usual fields of the arts and sciences leading to the degrees of Bachelor of Arts and Bachelor of Science. With the exception of pre-professional programs, day curricula are normally five years in length and operated on the Co-operative plan. In all-majors except chemistry and physics, however, qualified students with the approval of the dean may elect to complete requirements for the degree on a full-time plan in four years. The College also offers a number of its courses during evening hours, constituting a program leading to the Bachelor of Arts degree with curricula in economics, English, history and government, and sociology.

2. *The College of Education*

The College of Education offers the option of study on the conventional four-year full-time plan or on the five-year Co-operative Plan which provides for a period of teacher-internship in various school systems of the Greater Boston area. Both programs lead to the degree of Bachelor of Science in Education and are designed particularly to meet the needs of high school graduates who desire to prepare themselves for teaching or administrative positions in elementary and secondary schools.

The College also offers evening curricula leading to the degree of Bachelor of Science in Education in co-operation with the College of Liberal Arts.

3. *The College of Business Administration*

The College of Business Administration offers both day and evening programs of study in the principal fields of business leading to the degree of Bachelor of Science in Business Administration. The day programs are offered on the five-year Co-operative Plan under which students gain substantial practical experience in the fields for which they are preparing as an integral part of their undergraduate course of study.

Evening programs offered by the College meet the same academic requirements as the day curricula and lead to the same degrees. The evening programs of part-time study normally extend over approximately eight years.

4. *The College of Engineering*

The College of Engineering offers five-year co-operative curricula in civil, mechanical, electrical, chemical, and industrial engineering leading to the degree of Bachelor of Science with specification according to the engineering department in which the student qualified.

The College also offers during evening hours a full program leading to the degree of Bachelor of Science in Electrical Engineering. This program extends over nine years, covers the identical courses given in the day co-operative curriculum, and meets the same qualitative and quantitative standards of scholarship.

5. *University College*

University College, so called because it draws upon the resources of the other Colleges of the University, offers courses of study leading to certificates, associate degrees, or to Bachelor of Science degrees with specification of field of concentration. Programs of the College are designed specifically to meet the needs of older, more mature students who wish to undertake part-time programs of education during evening hours.

Although it is exclusively an evening College, the quality standards of instruction and the requirements for its degree are wholly consistent with those of the other Colleges of Northeastern University. University College does not duplicate the offerings of the Colleges of Liberal Arts, Business Administration, Education, and Engineering, but provides curricula which cut across traditional subject matter areas and meet the particular needs of adults desiring formal programs of professional development on a part-time basis.

II. The Graduate School

The Graduate School of the University offers day and evening programs of study leading to appropriate masters degrees in the fields of arts and sciences, education, business, and engineering. Some of these programs are offered on the Co-operative Plan; others provide teaching and research fellowships for able candidates. Administrative headquarters for all graduate programs are located on the first floor of the Graduate Center Building where the offices of the dean and of the several directors of professional programs are located.

III. Lincoln Institute

Lincoln Institute offers evening programs of study in several fields of science and engineering technology leading to the degree of Associate in Science or Associate in Engineering. The courses of study are of college grade and cover much of the technological subject matter customarily included in schools of engineering, but the curricula are less extensive in scope than those required for the baccalaureate degree in engineering. They prepare students to work with professional engineers in various technical capacities.

IV. Adult and Continuing Education

The Office of Adult and Continuing Education provides special programs and services for the business and industrial community. These include programs in management development, seminars, conferences, institutes, and forums designed to communicate information about current trends in various areas. The Office also sponsors a Bureau of Business and Industrial Training which sets up both off-campus and on-campus, short-term, non-credit courses to meet the specific training needs of industrial organizations in New England.

V. Research Activities

The Faculty of the University are engaged upon a wide variety of basic research projects in business, science, social science, and engineering. These are co-ordinated by the Dean of Research Administration whose services are University-wide and available to the Faculties of all the Colleges.

Although Northeastern is primarily concerned with undergraduate and graduate instruction in the areas of arts and sciences, business, engineering, and teacher education, the University believes that the most effective teaching and learning takes place in an environment characterized by research activities directed toward extending the frontiers of knowledge.

BUILDINGS AND FACILITIES

University Buildings

LOCATION

Northeastern University is located on Huntington Avenue, Boston. The main administrative offices of the University are located in Richards Hall.

The chief railroad centers of Boston are the North and South Stations. To reach the University from the North Station, board an MTA subway car going to Park Street and transfer there to any Huntington Avenue car. To reach the University from South Station, board a Cambridge-bound subway train and transfer at Park Street to a Huntington Avenue car. The "Northeastern" station is the first stop outside the subway.

HUNTINGTON AVENUE CAMPUS

The principal educational buildings of Northeastern University are located on a sixteen-acre site in the Back Bay section of Boston. Only one block to the west of the University lie the famous Boston Museum of Fine Arts and the beautiful public gardens-park reservation known as "The Fenway."

Following a long-range development plan, University facilities have expanded substantially in recent years. In addition to the seven buildings constructed within the last two decades, several modernized older buildings are available for specialized uses. The newer buildings on the campus are interconnected by means of tunnels, so that the students may go from building to building without going out of doors in inclement weather.

In addition to classrooms and instructional offices, the principal buildings include the following:

Botolph Building — Civil Engineering laboratories

Forsyth Building — Industrial and Mechanical Engineering laboratories

Greenleaf Building — ROTC headquarters, research facilities

The Robert Gray Dodge Library — Library, drawing rooms

Science Hall — Chemical Engineering and Biology laboratories

The Carl Stephens Ell Student Center — Student Activities, Health department, chapel, auditorium, and University Commons

Richards Hall — Administrative offices, Mechanical Engineering, Psychology and Chemistry laboratories, bookstore

The Godfrey Lowell Cabot Physical Education Center — gymnasium, cage, rifle range

Hayden Hall — Evening Division offices, Business, Education, and Electrical Engineering laboratories, art studio

Graduate Center — Administrative offices of the Graduate School, Physics laboratories and cafeteria

GENERAL INFORMATION

STUDENT BODY

THE STUDENTS of the Lincoln Institute represent men and women of earnest purpose and firm endeavor who bring to bear on their work a thoroughness which promises future success. Their ages last year ranged from seventeen to fifty-two, the average age being twenty-six years. Almost all the students are engaged in work during the day and many different occupations have their representatives in the student body, a fact which demonstrates that the Institute can be of service to men in many walks of life. Some students are preparing to enter engineering work; many are already engaged in engineering work and are studying to prepare themselves for increased responsibility and rewards.

TRANSPORTATION

THE RAILROAD SYSTEMS entering Boston issue students' tickets to students under twenty-one years of age. Veterans regardless of age are eligible for reduced rates on most of the railroads. Applications for these may be obtained at a railroad office and must be presented at the school office for signature.

The Administrative Office will do everything possible to make share-the-ride arrangements among members of the student body to accommodate those who have transportation problems.

LIBRARY AND STUDY AREAS

THE UNIVERSITY LIBRARY is well equipped in technical literature and is available for use of students of the Institute. The reading rooms are open from 9:00 A.M. to 7:30 P.M. on weekdays, and from 9:00 A.M. to 12:00 NOON on Saturdays. The privilege of obtaining books from the Boston Public Library is extended to students of the Institute. Applications for this privilege should be made directly to the Boston Public Library.

Adequate study areas are available in the Library and Student Center Building for student use.

TEXTBOOKS AND SUPPLIES

THE UNIVERSITY BOOKSTORE is operated for the convenience of the student body. All books and supplies which are required by the students for their work in the Institute may be purchased at the Bookstore which is located in the basement of Richards Hall.

PLACEMENT SERVICE

It is the policy of the Institute to serve the students whenever possible by placing them in those positions which promise attractive opportunities for development and advancement. The Institute cannot guarantee to place its students, but it does endeavor to keep in close touch with those who desire placement service and to assist them in obtaining satisfactory advancements in positions and income. No charge is made for placement service. Those needing this assistance should arrange an appointment with the Director of Placement.

VISITORS

Visitors are always welcome at one class session in any department. Those who wish to visit any of the classes should call at the school office and obtain a visitor's card signed by the Dean.

REQUIREMENTS FOR ADMISSION

REGULAR STUDENTS

Applicants for admission who present evidence of completion of an approved secondary school course, or the equivalent of fifteen units (including one unit in Algebra and one in Plane Geometry), may be admitted as regular students, candidates for the Degree of Associate in Engineering or Associate in Science and also eligible to proceed later, if they so desire, to the Degree of Bachelor of Science in Industrial Technology offered by University College of Northeastern University.

CONDITIONED STUDENTS

Applicants for admission who do not meet the full requirements for admission as regular students may, at the discretion of the Committee on Admission, be admitted as conditioned students provided such secondary school work as has been completed embraces one unit of Algebra and one unit of Plane Geometry.

A conditioned student whose scholarship is satisfactory but who has not removed his conditions within the time specified by the Committee on Admission may be permitted to continue with his program of studies, but on the completion of the chosen four-year curriculum he will receive a diploma indicating the completion of the program, but not carrying the award of the Degree of Associate in Engineering or Associate in Science.

SPECIAL STUDENTS

Students who wish to register for a special program or for single courses may be admitted as special students, not candidates for the Degree, provided their previous education and training are the equivalent of the prerequisite requirements for the courses in which they wish to enroll.

Programs are planned to meet individual needs and should prove of benefit to those who wish rapid and immediate knowledge of certain fields, whether to supplement former training or to obtain preparation which will permit them to enter a new line of endeavor.

CLASSIFICATION OF STUDENTS

Students are admitted to Lincoln Institute in September, January or June. Applicants admitted without entrance deficiencies may complete the requirements for the Associate Degree in four academic years by attending three evenings per week.

All applicants admitted to the freshman class as degree candidates are required to take the Mathematics Placement Test which is given on the following dates:

May 31, 1960 — for June (*Summer Term*) students

September 12, 1960 — for September (*Division A*) students

January 23, 1961 — for January (*Division B*) students

Those who demonstrate satisfactory proficiency in the test will proceed directly with the prescribed courses for the first year.

Inasmuch as success in the study of engineering is based upon a proficiency in Mathematics, those who receive a low score in the Placement Test (either because of inadequate preparatory courses or because of the length of time elapsed since graduation from secondary school) are classified as "Pre-Engineering Students" and must enroll for and satisfactorily complete a special comprehensive one-term course in Pre-Engineering Mathematics. Upon satisfactory completion of this course they are reclassified as degree candidates.

DIVISION A STUDENTS

Students starting in September who demonstrate satisfactory proficiency in the Mathematics Placement Test may, by attendance on three evenings per week, complete the prescribed courses for the freshman year in May. They may, however, elect a lighter scholastic load, thereby extending their programs of study.

Summer courses are not necessary for Division A students carrying the normal course load. However, those enrolled as candidates for the degree of Bachelor of Science in Industrial Technology may find it advantageous to complete certain of their management courses during the summer terms.

DIVISION B STUDENTS

Students starting in January and demonstrating satisfactory achievement in the Mathematics Placement Test may complete two of the three freshman year courses by attending three evenings per week from January to the middle of July.

PRE-ENGINEERING STUDENTS

Students who demonstrate in the Mathematics Placement Test a need for review in Mathematics are classified as Pre-Engineering Students and must enroll for the course Pre-Engineering Mathematics. This course, consisting of Algebra and Plane Geometry, is available in each of the three terms starting in September, January or June.

During the Fall and Spring Terms the course meets on Tuesday and Friday evenings from 6:50-9:30 P.M. In the Summer Term it meets three evenings a week for the first six weeks and two evenings a week for the next eight weeks.

Students enrolling for Pre-Engineering Mathematics in September may also concurrently enroll in the course Engineering Drawing. Satisfactory completion of Pre-Engineering Mathematics would then permit them to enroll in January for the regular Engineering Mathematics course. By taking Physics in the Summer Term they would then be ready to start the Sophomore year in September. However, attendance during the summer is not obligatory.

Students enrolled for Pre-Engineering Mathematics in the January and Summer Terms can complete but this one course. This, however, will qualify them to continue in September as degree candidates in the full freshman program.

ADMINISTRATIVE REGULATIONS

APPLICATIONS FOR ADMISSION

Applications for admission should be filed as early as possible in order that the necessary investigations may be made and the status of each student definitely determined before the opening day.

STUDENTS ADMITTED WITH ADVANCED STANDING

Advanced Standing Credit may be granted for work completed in other approved colleges or institutions provided the courses taken were equivalent to those offered by the Lincoln Institute. It will be necessary for the applicant to obtain an official transcript of record together with a catalogue and present them to the Dean before any action can be taken. This should be done no later than one week before the opening of the semester.

REGISTRATION

Each student is required to present himself at the school office, and to have his course approved by the Dean or his assistants and to complete his registration.

Students should avoid late registrations since no one is permitted to join a class after the second session. *No deduction from tuition fees is made because of late enrollment.*

THE SCHOOL YEAR

The school year is divided into two semesters of sixteen weeks each. The first semester extends from September 19 to January 27, and the second semester from January 30 to May 24. The summer term extends from May 31 to August 31, 1961.

During the summer term Pre-Engineering Mathematics, Algebra, Trigonometry, Engineering Drawing I and II, Physics I and II, are the only courses offered.

SESSIONS

Classes meet on weekday evenings. There are no classes on Saturdays. A full schedule will include three evenings a week. All classes meet from 6:50 to 9:30 P.M.

ATTENDANCE REQUIREMENTS

Class rolls close after the second session. Therefore, a student must attend either the first or second class session to be eligible for admission to a course.

A careful record of attendance upon class exercises is kept for each student. Absence from regularly scheduled classes on any subject will seriously affect the standing of the student.

A minimum attendance record of 75 per cent must be maintained in each class before a student will be admitted to examination. Students will be dropped from the class roll when their absences exceed 25 per cent of the class sessions. A student dropped for this reason *cannot be reinstated* and *no refund of tuition* will be granted.

Students who are unavoidably absent from class may receive the homework assignments by telephoning the school office.

TESTS AND QUIZZES

Final examinations are required upon the completion of all courses. Tests are held throughout the term at the discretion of the instructors.

A student desiring to make up a missed test or quiz must obtain a petition form from the Institute office, complete the petition and pay the required fee of \$3.00 in the Bursar's office. The receipted original must then be filed in the Institute office and the student's copy countersigned.

Make-up tests will be given on a Saturday at 1:30 P.M. in a designated room.

Petitions must be filed in accordance with the schedule listed below. Following is a list of petition and make-up dates for the school year 1960-1961:

<i>For Test Missed in</i>	<i>Must file Petition by</i>	<i>Must take Test on</i>
Sept. or Oct.	12:00 NOON, Saturday, November 5	November 19
November	12:00 NOON, Saturday, December 3	December 17
December	12:00 NOON, Saturday, January 7	January 21
February	12:00 NOON, Saturday, March 4	March 18
March	12:00 NOON, Saturday, April 8	April 22
April or May	9:00 P.M., Monday, May 1	May 13

In the event that an absence is known in advance, a petition may be filed before the quiz is missed. *No petition will be accepted after the dates specified for ANY reason.*

Any student who does not take the make-up test as scheduled will lose this make-up privilege.

TRANSFERS

Students are not permitted to change from one course to another without first consulting the Dean and receiving a Transfer Order signed by him.

GRADING SYSTEM

The following system of grading is used:

- A — Superior Work
- B — Above Average Work
- C — Average Work
- D — Lowest Passing Grade
- Inc — Incomplete (Given only when final examination is missed)
- F — Failure

A grade of "F" is a definite failure and the student must repeat the course in its entirety. No special examination will be allowed.

MAKE-UP EXAMINATIONS

The following policies govern make-up of final examinations:

If a student is absent from a final examination, he will receive a grade of "Inc." He may then petition for a special make-up final examination. This is a privilege which may be granted by the Committee on Education and is dependent upon the quality of the work the student has done throughout the course. If granted, the examination must be taken prior to the next final examination period. Failure to remove the "Inc" will result in it being changed to an "F."

The fee for each make-up examination is \$5.00.

QUALITY POINTS

The method of figuring quality points is as follows:

Each semester course grade of "A" is multiplied by 4; each "B" is multiplied by 3; each "C" is multiplied by 2; each "D" is multiplied by 1; and each "F" or "Inc" is multiplied by 0.

If a course meets two evenings per week, the point value will be doubled. Then the total number of quality points divided by the total number of course nights completed shall be the quality point average.

A student must achieve a quality point average of 1.75 to graduate from the Institute.

REPORTS OF STANDING

A report of the student's standing is issued at the end of each semester. Grades are mailed to the students and will not be given out at the school office. Under no circumstances will grades be given over the telephone. In the case of students who are under twenty-one years of age, reports may be sent to parents in the event of unsatisfactory work on the part of the student, non-compliance with administrative regulations, continued absence, and withdrawal. Parents of minors may obtain reports at any time on request.

GRADUATION REQUIREMENTS

Students may register for single subjects or for complete courses provided such registration meets with the approval of the Dean; but to receive the Degree of Associate in Engineering or Associate in Science, the student must fulfill the following conditions:

- a.* He must complete all the courses of his particular curriculum, either by attendance at this Institute, or by receiving advanced standing credit for those courses, or the equivalent of those courses, as determined by the Dean.
- b.* He must pass such final examinations as are required in the courses he has pursued. The various curricula have been arranged so that the courses can be completed in four years. However, an extension of time will be granted to those who wish to take longer to meet the requirements for graduation.
- c.* Regardless of the advanced standing credit he receives, he must have been in attendance for at least a year preceding the date on which he expects to graduate; that is, he must complete at least one full year's work in the Lincoln Institute.
- d.* He must have achieved a quality point average of at least 1.75 in the courses taken in the Institute. Courses for which a student has been awarded Advanced Standing Credit will not be counted in determining a student's scholastic average.
- e.* Upon graduation, honors will be conferred based upon the following quality point averages:

3.0 — Honor 3.5 — High Honor 3.75 — Highest Honor

In order to be eligible for honor graduation, a student must have completed at least two full years of work in the Lincoln Institute.

ATTENDANCE AT COMMENCEMENT

All candidates for a first degree (bachelor or associate) are required to attend Commencement in the year of qualification. First degrees in absentia are awarded only to candidates excused for personal or immediate-family illness, military service, or employment obligations beyond the control of the candidate.

A petition to receive a degree in absentia must be presented to the dean of the school or college in which the candidate qualifies. Each petition will be acted upon by the academic dean involved.

ACADEMIC STANDARDS

It is expected that the students will at all times endeavor to achieve a high record of attainment. The Committee on Education reserves the right to review all students' records and deny readmission to those students who fall below a minimum quality requirement. This requirement has been established as follows:

In order to be allowed to remain in the Institute, a student must have achieved a quality point average of 1.2 at the completion of 18 semester hours, 1.4 at the completion of 36 semester hours, and 1.6 at the completion of 54 semester hours. It should be further noted that a student who accumulates more than 18 semester hours of failures will not be eligible to continue in the Institute.

METHODS OF INSTRUCTION

Instruction is given by means of lectures, recitations, laboratory work and practical work in the drawing rooms. Great value is set upon the educational effect of these exercises, which constitute the foundation of each of the courses. Oral and written examinations are held at the discretion of the instructors.

The attention of every student is drawn to the fact that home assignments must be dutifully done and written work submitted as assigned if the student's grade is not to be seriously affected. Willful disregard of this matter will result in disciplinary action by the Administrative Officers.

SUBJECTS OF INSTRUCTION

On pages 56 to 70 will be found a detailed statement of the scope of the subjects offered in the various courses. The subjects are numbered for convenience of reference in consulting the various curriculum schedules.

Required courses, and those prerequisite thereto, must have been successfully pursued before any advanced course may be taken.

TUITION AND OTHER FEES

MATRICULATION FEE

A matriculation fee of \$10.00 must accompany the initial application for admission to the Institute. This fee is not refundable.

TUITION

Tuition fees are based on a charge of \$15.00 a semester hour. The tuition fee, therefore, is \$45.00 for a 3 semester hour course and \$90.00 for a 6 semester hour course. The charge for Pre-Engineering Mathematics is \$90.00.

A student who is carrying a normal load of three evenings per week would have a tuition charge of \$135.00 per semester.

Tuition is charged on a semester basis payable at the beginning of each semester. As a convenience to students, at their request and without additional charge, the Student Accounts Office will allow this bill to be paid in two payments.

LATE PAYMENT FEE

Payments are due by Saturday of the week in which the bill is dated. If payment is not made, or a deferred payment agreement arranged, by that date, a late fee of \$2.00 is charged.

DEFERRED PAYMENT PRIVILEGE

Occasionally situations develop—usually beyond the control of the student — which make it difficult to meet the payments in the manner outlined above. Under such circumstances the student is advised to discuss his problem personally with the Student Accounts Office where a convenient deferred payment agreement can be worked out. A service fee of \$2.00 is charged for this privilege.

LATE REGISTRATION FEE

Students are urged to register well in advance of the official opening of the semester, since any student who registers after Saturday of the opening week of the School term is charged a Late Registration Fee of \$5.00.

CHEMISTRY FEE

All students taking Chemistry are charged a Chemistry laboratory deposit of \$15.00, payable in September. Those students taking Organic Chemistry are required to make an additional deposit of \$10.00 at the beginning of the second semester.

The unused portion of the deposit will be refunded after deductions are made for breakages, chemicals, supplies and non-returnables.

SPECIAL EXAMINATION FEES

The fee for each special examination for conditioned students, or for students who have for justifiable cause omitted to take the regular scheduled final examinations, is \$5.00. The fee must be paid when the petition is filed.

The fee for each special test or quiz missed during the month is \$3.00 which must be paid when the petition is filed.

GRADUATION FEE

On completing the curricular requirements for the Degree of Associate in Engineering or Science, the student will pay a graduation fee of \$20.00. This fee must be paid by May 1 in the year of the student's graduation.

BOOKS AND SUPPLIES

Students purchase their own textbooks and work materials. The cost varies according to the subject for which the student is enrolled. The average cost for a normal program of three subjects is about \$25.00. Textbooks for a single course range from \$4.00 to \$15.00.

Students taking Engineering Drawing should be prepared to expend a sum of approximately \$18.00 for drawing supplies and \$22.00 for a set of drawing instruments in addition to the textbooks which cost approximately \$9.50.

REFUND OF TUITION

The University provides all instruction and accommodations on an academic semester basis; therefore, no refunds are granted except in cases where students are compelled to withdraw on account of personal illness or other reasons beyond their control. In no event will a refund be made if the individual's attendance is recorded beyond the fifth class session. A student must complete an official withdrawal application before being considered for refund. Questions regarding refunds should be discussed with the Bursar's Office.

PROGRAMS OF INSTRUCTION

The Lincoln Institute offers evening programs of study leading to the degree of Associate in Engineering in the major fields of Civil, Mechanical, Electrical and Electronic Engineering Technology, and the degree of Associate in Science in the field of Chemistry.

The courses of study are of college grade and cover much of the technological subject matter customarily included in schools of engineering but the curricula are less extensive in scope than those required for the baccalaureate degree in engineering. They prepare students to work with professional engineers in various technical capacities.

Students normally attend on a schedule of three evenings a week for four years. In those cases where students are unable to carry all of the work prescribed in any year, the Dean will grant an extension and determine the order in which courses shall be taken to satisfy prerequisite requirements.

The credits earned in the Associate Degree programs can be used to satisfy the engineering requirements for the Degree of Bachelor of Science in Industrial Technology which is offered in conjunction with University College of Northeastern University.

CHEMISTRY

Leading to the Degree of Associate in Science

The Science of Chemistry has undergone a marked development in recent years. It has grown out of the discoveries of the chemical laboratories which have launched many new industries whose production processes involve chemical as well as physical change. The chemist is in demand and his aid is sought in the operation of plants producing drugs, oils, rayon and cellophane, plastics and various synthetic products resulting from intensive research during the war. The chemist may assist in the creation of more economical manufacturing processes, promote the development of manufacturing by-products, and be instrumental in the discovery of new products in the research laboratories.

In addition to the fundamental courses in chemistry, mathematics, and physics, a considerable amount of time is devoted to more advanced work in chemistry. Since the field is so varied, the curriculum has been designed to give the students a broad training rather than a specialized training in one specific industry.

Prerequisite: Satisfactory completion of the Mathematics Placement Test or the Pre-Engineering Mathematics Course. (700)

FIRST YEAR

First Semester			Second Semester		
Course No.	Course	Semester Hours	Course No.	Course	Semester Hours
701	Algebra	3	702	Trigonometry	3
601	Engineering Drawing I . . .	3	602	Engineering Drawing II . .	3
801	Physics I	3	802	Physics II	3
		—			—
		9			9

SECOND YEAR

703	Analytical Geometry and Differential Calculus . . .	3	704	Integral Calculus	3
101	General Chemistry I	3	102	General Chemistry II	3
151	General Chem. Lab I	3	152	General Chem. Lab II	3
		—			—
		9			9

THIRD YEAR

103	Qualitative Chemistry	3	104	Quantitative Chemistry . . .	3
153	Qualitative Analysis Lab . .	3	154	Quantitative Analysis Lab .	3
501	Applied Mechanics I	3	502	Applied Mechanics II	3
		—			—
		9			9

FOURTH YEAR

107	Physical Chemistry I	3	108	Physical Chemistry II	3
105	Organic Chemistry I	3	106	Organic Chemistry II	3
155	Organic Chem. Lab. I	3	156	Organic Chem. Lab II	3
		—			—
		9			9

CIVIL ENGINEERING TECHNOLOGY

Leading to the Degree of Associate in Engineering

The field of Civil Engineering has to do with the planning and building of all kinds of structures and public works. Today its major branches include topographical, municipal, railroad, highway, structural, hydraulic, and sanitary engineering. It covers land surveying, the building of railroads, soil mechanics, harbors, docks, the construction of sewers, water works, streets and highways, the design and construction of flood control projects, bridges, buildings, walls, foundations, and all fixed structures.

This curriculum is designed to offer the relatively compact body of principles upon which much of the work of Civil Engineering depends. It is intended to prepare young men to assist in the work of design and construction of structures, to assist in solving the problems of water supply, and to undertake intelligently the supervision of work in allied fields of engineering and general contracting.

Prerequisite: Satisfactory completion of the Mathematics Placement Test or the Pre-Engineering Mathematics Course. (700)

FIRST YEAR					
First Semester			Second Semester		
Course No.	Course	Semester Hours	Course No.	Course	Semester Hours
701	Algebra.....	3	702	Trigonometry.....	3
601	Engineering Drawing I...	3	602	Engineering Drawing II...	3
801	Physics I.....	3	802	Physics II.....	3
		—			—
		9			9
SECOND YEAR					
703	Analytical Geometry and Differential Calculus....	3	704	Integral Calculus.....	3
201	Surveying I.....	3	202	Surveying II.....	3
501	Applied Mechanics I.....	3	502	Applied Mechanics II.....	3
		—			—
		9			9
THIRD YEAR					
203	Transportation Engineer- ing.....	3	204	Hydraulics.....	3
503	Strength of Materials I....	3	504	Strength of Materials II...	3
213	Structural Drawing I.....	3	214	Structural Drawing II....	3
		—			—
		9			9
FOURTH YEAR					
207	Concrete Design I.....	3	208	Concrete Design II.....	3
205	Structural Analysis I.....	3	206	Structural Analysis II.....	3
†209	Structural Design I.....	3	†210	Structural Design II.....	3
†211	Water Supply.....	3	†212	Sewerage and Sewage Dis- posal.....	3
		—			—
		9			9

† Students elect one of these two courses.

ELECTRICAL ENGINEERING TECHNOLOGY**Leading to the Degree of Associate in Engineering**

The Electrical Engineering profession affords a wide diversification of employment opportunities. The Electrical industry and the general field of Electrical Engineering are generally divided into two main branches, one having to do with electrical power and the other, electronics and communications. The power group deals principally with larger equipment and apparatus employing heavy currents; the communications group involves more delicate equipment with smaller current values. Electrical Engineering thus includes the generation, transmission and distribution of electrical energy for light and power purposes, the application of d-c and a-c machinery to industry, and the operation of all types of electrical equipment, including communications, radio and electronic apparatus.

This course of study provides a good theoretical background with practical applications. Instruction is carefully planned and the time is divided among lecture, laboratory testing, homework and reports.

Prerequisite: Satisfactory completion of the Mathematics Placement Test or the Pre-Engineering Mathematics Course. (700)

FIRST YEAR

First Semester			Second Semester		
Course No.	Course	Semester Hours	Course No.	Course	Semester Hours
701	Algebra	3	702	Trigonometry	3
601	Engineering Drawing I . . .	3	602	Engineering Drawing II . .	3
801	Physics I	3	802	Physics II	3
		—			—
		9			9

SECOND YEAR

703	Analytical Geometry and Differential Calculus . . .	3	704	Integral Calculus	3
301	D-c Theory	3	302	A-c Theory	3
501	Applied Mechanics I	3	502	Applied Mechanics II . . .	3
		—			—
		9			9

THIRD YEAR

303	D-c Machinery	3	304	A-c Machinery	3
353	D-c Machinery Lab.	3	354	A-c Machinery Lab. I . . .	3
503	Strength of Materials I . . .	3	504	Strength of Materials II . .	3
		—			—
		9			9

FOURTH YEAR

355	A-c Machinery Lab. II . . .	3	356	Electronics for Industry Lab.	3
305	Electronics for Industry . .	3	306	Transmission-Line Theory	3
505	Heat Engineering I	3	506	Heat Engineering II	3
		—			—
		9			9

ELECTRONIC ENGINEERING TECHNOLOGY

Leading to the Degree of Associate in Engineering

This course is designed to train students for the various branches of the field of Electronics. The new advancements in the fields of radio, television, radar and sonar created by the urgencies of war have opened up greater opportunities for intellectual pioneering in these fields of engineering than in other branches of the profession.

Since electron tubes and circuits function around the principles of Electricity, this subject is adequately treated in the second year of the course. After a thorough study of the various types of electron tubes and their basic circuits in the third year, the fourth year is devoted to the various important fields that the student may wish to enter, such as Communications, Microwaves and Radar, and the new fields of Transistors and Tele-metering.

The whole course is a good balance between theory and practice, and experiments involving electron tubes and their applications are used through the last three semesters of the course. Laboratory reports and homework problems are used to supplement the experiments and lectures so that the student will absorb the material in a thorough manner.

Prerequisite: Satisfactory completion of the Mathematics Placement Test or the Pre-Engineering Mathematics Course. (700)

FIRST YEAR					
First Semester			Second Semester		
Course No.	Course	Semester Hours	Course No.	Course	Semester Hours
701	Algebra.....	3	702	Trigonometry.....	3
601	Engineering Drawing I...	3	602	Engineering Drawing II...	3
801	Physics I.....	3	802	Physics II.....	3
		—			—
		9			9
SECOND YEAR					
703	Analytical Geometry and Differential Calculus....	3	704	Integral Calculus.....	3
301	D-c Theory.....	3	302	A-c Theory.....	3
401	Wave Propagation.....	3	402	Semiconductors and Transistors.....	3
		—			—
		9			9
THIRD YEAR					
**405	Electron Tubes and Circuits I.....	6	**406	Electron Tubes and Circuits II.....	6
403	Electrical Measurements..	3	456	Electronic Lab.....	3
		—			—
		9			9
FOURTH YEAR					
**407	Communication Engineering I.....	6	**408	Communication Engineering II.....	6
457	Advanced Electronic Lab. I.....	3	458	Advanced Electronic Lab. II.....	3
		—			—
		9			9

**Two nights per week.

MECHANICAL ENGINEERING TECHNOLOGY

Leading to the Degree of Associate in Engineering

The field of mechanical engineering is concerned with the harnessing of our power resources by means of machinery to perform useful work. In contrast to civil engineering which deals primarily with static forces, mechanical engineering is more concerned with the mechanics of motion or kinetics. And because moving parts require constant care and adjustment, there is the task not only of designing and installing complicated machinery, but also of operating it efficiently after it has been installed.

Among the major branches of mechanical engineering are included power, production engineering, machine and machine-tool design, railway mechanical engineering, automotive engineering, aeronautical engineering, refrigerating engineering, air conditioning engineering, and the numerous mechanical problems related to modern industrial operation.

This program of study is designed to give the student considerable training in the principles of mechanical engineering technology and equip him for advancement in the many subdivisions of this branch of engineering.

Prerequisite: Satisfactory completion of the Mathematics Placement Test or the Pre-Engineering Mathematics Course. (700)

FIRST YEAR					
First Semester			Second Semester		
Course No.	Course	Semester Hours	Course No.	Course	Semester Hours
701	Algebra	3	702	Trigonometry	3
601	Engineering Drawing I . . .	3	602	Engineering Drawing II . .	3
801	Physics I	3	802	Physics II	3
		—			—
		9			9
SECOND YEAR					
703	Analytical Geometry and Differential Calculus . . .	3	704	Integral Calculus	3
603	Machine Drawing I	3	604	Machine Drawing II	3
501	Applied Mechanics I	3	502	Applied Mechanics II	3
		—			—
		9			9
THIRD YEAR					
507	Mechanism	3	204	Hydraulics	3
503	Strength of Materials I . . .	3	504	Strength of Materials II . .	3
505	Heat Engineering I	3	506	Heat Engineering II	3
		—			—
		9			9
FOURTH YEAR					
508	Machine Design I	3	509	Machine Design II	3
551	Mechanical Engineering Laboratory I	3	552	Mechanical Engineering Laboratory II	3
**	Engineering Elective	3	**	Engineering Elective	3
		—			—
		9			9

**The electives available are Concrete Design, De-Ac Theory, General Chemistry Lectuae, Structural Analysis, Structural Drawing, Surveying.

INDUSTRIAL ENGINEERING TECHNOLOGY

Students who are interested in pursuing a program in Industrial Engineering Technology should enroll for the Associate Degree in Mechanical Engineering Technology.

Upon completion of this program they should then enroll in University College for the Manufacturing Management program.

Satisfactory completion of these two phases will allow a student to qualify for the Degree of Bachelor of Science in Industrial Technology.

CONTROL SYSTEMS ENGINEERING TECHNOLOGY

The rapid technological advances of the space age bring a need for the specialist to keep his own technical development abreast of the changes. Attuned to this need is the special sequence of courses offered by Lincoln Institute for technical personnel engaged in research and development related to control systems. Here the complex technology of engineering systems is effectively analyzed through basic foundation courses for the man wishing to advance his professional growth in either of two specific areas:

Control Systems

Control Devices

Admission qualifications include the Associate Degree in Electrical or Electronic Engineering or its equivalent in education or experience. Graduates out of college ten or more years will also find the program helpful for up-grading in current developments.

Each course carries four units of credit per year. A certificate is awarded upon satisfactory completion of sixteen units of credit selected from among courses listed below:

Transients in Linear Systems	Statistical Inferences
Pulse Circuits	Probability Theory
Transistor Circuit Engineering	Operations Research
Radar Engineering	Microwave Theory
Analog and Digital Computers	Communications Theory
Servomechanisms	

A unit equals one hour of instruction per week for a sixteen week semester. Tuition for these courses is charged at the rate of \$30.00 per unit.

Those interested in this program are urged to contact the school office and request a special brochure describing the program in full detail.

ENGINEERING AND MANAGEMENT

Leading to the Degree of Bachelor of Science in Industrial Technology

The Engineering and Management curriculum combines the fundamental courses in one of the several areas of engineering with an integrated program in management, the humanities and the social sciences to provide a broad background of training for those who aspire to positions of managerial responsibility where technical knowledge is required.

The curriculum is offered by University College in conjunction with the Lincoln Institute, one of the affiliated schools of Northeastern University. The engineering requirements may be earned by satisfactory completion of equivalent courses in an accredited engineering college.

The total credit requirements for the degree are 130 semester hours distributed as follows:

	<i>Semester Hours</i>
Engineering Credits applicable from Associate Degree	60
Additional technical courses beyond the Associate Degree requirements, and not to exceed 10 semester hours, may be taken upon prior approval of the Dean of University College; credits so earned will substitute for management electives.	

Management Courses — Required Core

English	4	Labor-Management Relations	2	
Economics	4	Managerial Accounting	4	
Finance I	2	Statistics	2	
Industrial Management	4	Managerial Statistics	2	
Law for Engineers	2	Psych. for Bus. & Ind. I	2	28
				24

Liberal Arts — Required

LA1-2 Man and the Physical Universe	LA5-6 Man's Cultural Inheritance
LA3-4 Man in Society	LA7-8 Man and Values

Management Courses — Electives

(chosen from one of the options listed below)	18
Total semester hours required for degree	130

OPTIONS

<i>Production</i>	<i>Semester Hours</i>	<i>Technical Sales</i>	<i>Semester Hours</i>
Work Simplification I.....	2	Government Controls.....	2½
Work Measurements I.....	2	Distribution, Prin.....	4
Production Processes.....	2½	Purchasing.....	2½
Material Handling.....	5	Salesmanship.....	2½
Production Plan. & Control.....	4	Sales Management.....	2½
Quality Control.....	2½	Sales Promotion.....	2½
Plant Layout.....	5	Transportation Practices.....	2½
Managerial Economics.....	2½	Office Management Practices.....	2½
Manufacturing Mgmt.....	2½	Business Org. & Adm.....	2½
Materials Mgmt.....	2½	Credit Fundamentals.....	2½
Human Relations.....	5	Human Relations.....	5
Business Org. & Admin.....	2½	Finance II.....	2
Finance II.....	2		

Administrative

Government Controls.....	2½	Business Org. & Admin.....	2½
Human Relations.....	5	Distribution, Prin.....	4
Insurance for Mgmt.....	2½	Purchasing.....	2½
Labor Agreements.....	2½	Credit Fundamentals.....	2½
Labor Legislation.....	2½	Electronic Data Processes.....	2½
Managerial Economics.....	2½	Adv. Data Proc.-Programming....	2½
Office Management Practices.....	2½		

Courses other than those shown above may be taken upon approval of the Dean if they are consistent with the student's educational pattern.

ENGINEERING LABORATORY EQUIPMENT

The Lincoln Institute has available for its use all of the laboratory facilities of the College of Engineering. These include the following:

CIVIL ENGINEERING LABORATORIES

A considerable amount of demonstration equipment including many models is available for use in the study of structures, hydraulics, sanitary engineering, highways, concrete and soil mechanics.

Surveying

The Department of Civil Engineering is provided with a variety of excellent and up-to-date equipment for field work. The instruments have been chosen to make possible the working out of advanced as well as elementary field problems, and to acquaint the students with the principal makes and types of instruments in general use including several calculating machines.

Hydraulics, Sanitary, and Bacteriological Engineering

These laboratories, located on the basement and first floors of the Botolph Building, are equipped with demonstration measuring devices for use in connection with the courses in hydraulics.

Complete equipment is also provided for studies of water softening, filtration, coagulation, analysis of water and sewage by the photometer, and analysis of bacterial condition of water and sewage. Specialized equipment for advanced courses in sanitary research is also available.

Highway Materials

(Cement, Concrete, Soils, and Asphalt)

Located on the first floor of the Botolph Building, this modern, temperature-humidity-controlled laboratory is equipped for conducting all the routine tests on cement, aggregate and concrete. Considerable equipment is available for conducting research work.

Equipment is also available for conducting a major portion of the accepted tests on bituminous materials and aggregates as used in highway work as well as Marshall Stability Unit for bituminous concrete. Soil Mechanics equipment consists of a general soil sampler, wet-mechanical grain-size analysis, Tri-axial Test equipment, Permeability, OMC unit, CBR equipment, two Tri-axial units and four Consolidation loading frames, and a Hydraulic Consolidometer.

Aerial Photogrammetry

The apparatus in this laboratory may be used to instruct the students in the basic principles of photogrammetry, or may be used to instruct the students in the more technical phases of photogrammetry such as horizontal control, vertical control, stereoscopic plotting, mechanical triangulation, and the tri-metrogon method of plotting.

CHEMICAL LABORATORIES

For experiments and investigations in Chemistry there are available three laboratories with the following equipment:

Analytical Chemistry

The laboratory for Analytical Chemistry is fully equipped for giving instruction in the usual undergraduate courses. Each student is supplied with the necessary laboratory glassware, porcelain, and the standard pieces of hardware. Special equipment of all needed types is available.

This laboratory is equipped with high pressure steam, vacuum, and the facilities usually found in an analytical laboratory. The various instruments and other chemical equipment necessary for the examination, testing, and analysis of the raw materials, intermediate and final products of the various industries are at hand.

The electrical equipment includes a Kimley electro-analysis machine for the determination of copper, lead, nickel, and zinc; a Hevi-duty electric furnace for use in ignition and combustion work; and a Freas drying oven capable of adjustment for various temperatures. Power is available in a variety of d-c and a-c voltages.

An adjoining balance room is equipped with balances suitable for quantitative analytical work.

Inorganic Chemistry

In the locker assigned to each student for his individual use are the articles needed more or less continually by him as he does his experiments in the laboratory sessions. He has a liberal supply of glass, porcelain, metal and other articles. Additional pieces of apparatus are issued from the stockroom or otherwise made available for use in particular experiments where they are needed.

The laboratories are equipped with general facilities appropriate to this course, such as gas, electricity, cold and hot water, fume hoods.

Organic Chemistry

The needed equipment is available. There are individual lockers and apparatus, fume hoods for general use, and special equipment, as required.

Drying operations are carried out with the aid of a steam-heated drying chamber and electrically heated drying oven. Steam lines on the benches supply the steam for steam distillations, eliminating the necessity of individual steam generators.

ELECTRICAL ENGINEERING LABORATORIES

The Electrical Engineering laboratories are located in Hayden Hall. Three laboratories are included in this unit: Dynamo; Industrial Electronics and Control; and Communications Laboratories.

Dynamo

This laboratory is provided with both 60 cycle per second three-phase, 230-volt alternating-current and 115/230-volt three-wire direct-current sources. The equipment includes more than sixty motors and generators of different types together with the necessary auxiliary equipment to operate and test them. The motors and generators have been selected so as to reduce as much as possible the risk from high voltage while making available to the students a representative range of commercial apparatus.

Industrial Electronics and Control Laboratory

This laboratory is designed to offer experiments in the application of electronic tubes and circuits to industry. In addition to basic electronic-control circuits, there are larger pieces of equipment, including the control of d-c generator voltage, d-c motor speed control, thyatron and ignitron rectifiers, electronic synchronization of a-c sources, and induction heating, as well as servomechanism devices.

Communications Laboratory

This laboratory is equipped with apparatus to demonstrate and test the many ramifications of electronic equipment used in low, audio, radio-frequency and high-frequency circuits. Available are many electronic instruments, including vacuum-tube voltmeters, cathode-ray oscilloscopes, audio and radio-frequency oscillators, wave-analyzers, pulse-generators and equipment operating

at radar frequencies, as well as many other types used in telephone, radio, and television communication circuits; included also is equipment planned for teaching the principles of electrical measurements and calibrations.

ELECTRONIC ENGINEERING LABORATORIES

The Electronics laboratories are located in the Forsyth Building and Hayden Hall.

Electron Tubes and Circuits

Equipment is available to study the operating of all types of electron tubes that are normally used, extending from diodes through to beam tubes, gas triodes, photocells, cathode ray tubes, transistors, and the various rectifier, amplifier and other basic circuits used with them, including vacuum tube voltmeters, impedance bridge, regulated power supplies, resistance coupled amplifiers, inverse feedback amplifiers, wide band oscilloscopes, audio generators and lecher wire.

Communication Engineering

Equipment available for this course includes crystal oscillators, audio and radio oscillators, narrow and wide band and power radio frequency amplifiers, frequency doublers, plate and grid modulation units, modulation meters, radio frequency transmission lines, push-pull audio amplifiers, Q-meters, intermodulation meter and transistor circuits. The frequency modulation apparatus includes balanced modulators, reactance modulators, phase modulators, discriminators, panoramic adapters, limiters, and networks. The RCA dynamic demonstrator, plus detector, and IF amplifier units are used for receiver experiments.

Apparatus for television and radar circuitry includes sweep oscillators and amplifiers, synchronizing circuits, video amplifiers, delay lines, multivibrators, counters, clipping, shaping, and television receiving equipment. A complete rack of television test equipment is available. This includes a sweep generator, marker generator, wide band oscilloscope, master voltohmmyst, wave analyzer, etc. The RCA dynamic generator is used for complete TV receiver studies. Apparatus for wave guides, frequency counters, analogue computers and slotted lines is also available.

To keep up with the expanding field of Electronics, both equipment and experiments are added and modified each year.

INDUSTRIAL ENGINEERING LABORATORY

The Industrial Engineering Laboratory is located in the Forsyth Building and is devoted exclusively to methods engineering and time study analysis. This laboratory is completely equipped with the latest facilities and tools used by industrial engineers. Besides the general equipment consisting of benches, tables, lathes, jigs, fixtures, and racks, the laboratory has an ample supply of time study boards, stop watches and timers for time study work. There is also available complete motion picture equipment and microchronometers for micromotion work.

Students in the Department of Industrial Engineering also share in the use of the Mechanical Engineering Laboratories.

MECHANICAL ENGINEERING LABORATORIES

The Mechanical Engineering Department has a well-equipped laboratory, containing a large variety of modern machines and occupying over 10,000 square feet of floor space in the basement of Richards Hall, as well as about the same area in the basement of the Forsyth building. Special areas have been set aside and equipped for oil testing, mechanics research, and similar purposes. Auxiliary equipment is, of course, available for making all the usual tests and measurements.

Steam Power

This equipment includes a wide variety of steam engines, turbines, pumps, heat exchangers, and measuring instruments.

Testing Materials and Heat Treatment

For tension, compression, bending, and shearing tests, the laboratory is equipped with a 300,000 lb. capacity Riehle, a 200,000 lb. and a 50,000 lb. capacity Olsen, as well as several smaller testing machines. For other tests the laboratory has torsional testing machines, impact testers, fatigue testers, hardness testers, extensometers, oil testing equipment, calorimeters, as well as instruments for measuring speed, vibration, temperatures, pressures and flow of fluids.

For heat treatment studies, electric furnaces and a gas-fired furnace are available. Equipment magnifying up to 2600 diameters is available for photographing crystalline structures, and the laboratory has polaroid equipment for photoelastic stress analysis.

Machine Shop

Adjoining the laboratory is a machine shop fully equipped with machine tools and welding equipment.

Internal Combustion, Aeronautics, and Miscellaneous

The internal combustion equipment includes a number of gas and oil, automobile, airplane, and Diesel engines. Most of these are set up for running experimental tests, but several are available for dismantling and demonstration purposes.

An open circuit Venturi type wind tunnel having a three-foot throat and capable of 120 miles per hour wind velocity is available for experimental and demonstration work in the measurement of air forces on model planes and other structures.

In addition to the above equipment, there is an oil-fired steam boiler, hot-air furnace, unit heater, air conditioning units, centrifugal fan and several weirs for measuring water flow.

Metallography tests with microscopes and photographic apparatus may be performed.

DESIGN AND DRAFTING ROOMS

The School possesses large, light, and well-equipped drawing rooms for the carrying on of the designing and drafting which form so important a part of engineering work. These rooms are supplied with individual drawing tables and stools. Drafting room blackboards are equipped with traveling straightedge devices which facilitate speed and accuracy in blackboard demonstrations.

PHYSICS DEPARTMENT

Two large amphitheater lecture rooms, located in the Graduate Center Building, are provided with motion picture facilities, a public address system, a projection galvanometer, and a demonstration table equipped with water, compressed air, exhaust and both a-c and d-c electrical outlets.

The equipment which is used for illustrating the fundamental principles of physics has been carefully selected and adapted especially for lecture demonstrations. The following is a partial list of the available apparatus that supplements the usual equipment for this purpose: Hartl optical disk; eight-foot slide rule; vacuum pumps; calorimeters; optical benches with associated equipment; large demonstration cathode-ray oscilloscope; spectroscopes; projection apparatus; Van de Graaff electrostatic generator; sound and wave apparatus.

DESCRIPTION OF COURSES

THE LINCOLN INSTITUTE reserves the right to withdraw, modify, or add to the courses offered or to change the order or content of courses in any curriculum.

The Lincoln Institute further reserves the right to change the requirements for graduation, tuition and fees charged, and other regulations. However, no change in tuition and fees at any time shall become effective until the school year following that in which it is announced.

Any changes which may be made from time to time pursuant to the above policy shall be applicable to all students in the school, college, or department concerned, including former students who may re-enroll.

CHEMISTRY

101 General Chemistry I

This course will instruct in the fundamental ideas of matter and energy; properties of gases, liquids, and solids; molecular and atomic weights; theory of valence; classification of the elements; chemistry of metals and non-metals; the solution of all types of problems to illustrate practical applications.

(Prerequisite, 701, 702, 801, 802)

3 semester hours credit

102 General Chemistry II

A continuation of General Chemistry I; ionic reactions; electrochemistry; introduction to organic chemistry including industrial applications to petroleum, rubber, synthetic resins, plastics; chemotherapy; introduction to qualitative analysis.

(Prerequisite, 101)

3 semester hours credit

103 Qualitative Chemistry

The object of this course is not only to give instruction in analytical procedure and technique, but also to give the student a knowledge of the application of the fundamental concepts of solutions to the laboratory work. A portion of the time is devoted to the formulation of numerical terms which are essential to the understanding of the mass action law, ionic equilibria, solubility product, hydrolysis, and redox constants.

(Prerequisite, 101, 102)

3 semester hours credit

104 Quantitative Chemistry

It is the purpose of this course to give to the student a realization of the scientific development of quantitative methods. Each of the major operations such as weighing, measurement of volumes, titration, filtration, ignition, and combustion, is considered from the standpoint of the theo-

retical principles involved, and with due consideration of the manipulative technique necessary.

This is followed by the combination of these operations and their application to actual analysis, including a comprehensive study of volumetric methods and of the more elementary parts of gravimetric analysis.

As the correct calculation of analytical results is of no less importance than the actual procedures of analysis, a number of problems form a very important part of the course.

(Prerequisite, 103)

3 semester hours credit

105 Organic Chemistry I

This course presents the general principles of structure, nomenclature, preparation, uses and reactions of the most important types of aliphatic carbon compounds. The topics in order are: Petroleum and coal products, halogen compounds, alcohols, ethers, aldehydes and ketones, carboxylic acids and derivatives, and carbohydrates.

(Prerequisite, 101, 102)

3 semester hours credit

106 Organic Chemistry II

A continuation of Organic Chemistry I. Topics included are: Aromatic hydrocarbons, phenols, halogen derivatives, nitrogen compounds, dyes, sulfur compounds, polyfunctional compounds, stereoisomerism, natural and synthetic polymers, alicyclic and heterocyclic compounds.

(Prerequisite, 105)

3 semester hours credit

107 Physical Chemistry I

This lecture course covers the fundamentals of physical chemistry. The topics discussed include: The three states of matter, the solution laws, surface phenomena and colloids, thermochemistry, and chemical equilibrium.

(Prerequisite, 104, 704)

3 semester hours credit

108 Physical Chemistry II

This course continues lecture course Physical Chemistry I and includes the topics: Ionic equilibrium, electrochemical cells and electrolysis, kinetics of chemical reactions, atomic and molecular structure, and radioactivity. Practical applications of these fundamentals are discussed whenever possible.

(Prerequisite, 107)

3 semester hours credit

151 General Chemistry Laboratory I

This course consists of a series of laboratory experiments operated in conformance with the lecture course in General Chemistry I.

(Prerequisite, 101 or concurrently)

3 semester hours credit

152 General Chemistry Laboratory II

This course consists of a series of laboratory experiments operated in conformance with the lecture course in General Chemistry II.

(Prerequisite, 151, 102 or concurrently)

3 semester hours credit

153 Qualitative Analysis Laboratory

This course applies the material covered in Qualitative Chemistry to actual problems. After some preliminary experiments, certain procedures are combined and the separations and identifications made on both known and unknown solutions. Finally, these are combined into a comprehensive system of analysis which is applied to artificially prepared mixtures and industrial materials. Careful manipulations, thoroughness in observation, and accuracy in arriving at conclusions are expected of each student.

(Prerequisite, 151, 152, 103 or concurrently) 3 semester hours credit

154 Quantitative Analysis Laboratory

This is a laboratory course intended to illustrate by actual use the various analytical methods considered in Quantitative Chemistry. After certain preliminary experiments designed to acquaint the student with the apparatus used, volumetric analysis, including acidimetry and alkalimetry, oxidation, reduction, and precipitation methods are taken up. This is followed by simple gravimetric analyses.

(Prerequisite, 153, 104 or concurrently) 3 semester hours credit

155 Organic Chemistry Laboratory I

This course is co-ordinated with the lecture course Organic Chemistry I and deals with the preparation and reactions of the aliphatic compounds.

(Prerequisite, 105 or concurrently) 3 semester hours credit

156 Organic Chemistry Laboratory II

This course is co-ordinated with the lecture course Organic Chemistry II and deals with the preparation and reactions of the aromatic compounds.

(Prerequisite, 155, 106 or concurrently) 3 semester hours credit

CIVIL ENGINEERING TECHNOLOGY**201 Surveying I**

A course of lectures which treats the basic principles, such as taping, compass, theory and use of the transit as applied to both random and closed traverses, differential leveling, profile leveling, and double-rod leveling. The D.M.D. and Rectangular Co-ordinate methods of computing, plotting and running traverses are stressed and especially as they may apply to such work or procedure as outlined by the Massachusetts Land Court.

The theory and use of the plane table, including the intersection, resection, and three point problem is also studied.

(Prerequisite, 702) 3 semester hours credit

202 Surveying II

A course of lectures and problems on simple curves (railroad curves and circular arcs), vertical curves, compound curves and Stadia surveying. The method of obtaining cross-sectional areas is taught. The student is instructed in the preparation of earthwork tables and the solution of the Mass diagram.

(Prerequisite, 201) 3 semester hours credit

203 Transportation Engineering

This course consists principally of a discussion of modern highway engineering practices. The general features of routing, such as horizontal and vertical curves, rates of grade, superelevation, and traffic control are studied both from the viewpoint of safety and economics. Materials and tests of materials used in the construction of both highway and airport projects are discussed, including drainage problems and frost-action in subgrades. The major portion of the course is spent on the construction procedure of the several types of roadways. These consist of the low-cost types such as stabilized soils, gravel, and crushed stone. The higher-cost types of roadways such as Penetrated Macadam, Portland cement concrete, brick pavements, and Asphaltic Concrete are included. A brief discussion of airport design and layout concludes the course.

The application of the latest research development is considered throughout the entire course.

(Prerequisite, 202)

3 semester hours credit

204 Hydraulics

This course is a study of the principles of both hydrostatics and hydrodynamics. The subjects considered are the pressure on submerged areas together with their points of application; the laws governing the flow of fluids through orifices, short tubes, nozzles, weirs, pipe lines, and open channels; Reynolds numbers; and viscosity.

(Prerequisite, 501, 502, 704)

3 semester hours credit

205 Structural Analysis I

First term in this theory course covers the equilibrium of forces and structures by analytical and graphical methods. Shear and moment diagrams are reviewed and expanded. Analytical and graphical analysis of roof trusses and mill building frames are worked out. The use of influence lines in analyzing loads on beams, girders, and trusses is discussed as well as absolute maximum moment in beams.

(Prerequisite, 504)

3 semester hours credit

206 Structural Analysis II

The work in the second term consists of analyzing the stresses in various types of railroad and highway bridge trusses by means of move-up load method and equivalent uniform loadings. Deflections of beams and trusses by Method of Virtual Work (dummy load) Moment-Area, Slope and Deflection, 3-Moment Equations, Method of Least Work as well as Moment Distribution methods are used to analyze Indeterminate Structures.

(Prerequisite, 205)

3 semester hours credit

207 Concrete Design I

A consideration of the theoretical and practical principles involved in the design of reinforced concrete structures. The following subjects are thoroughly discussed: The manufacture of Portland cement; the specification requirements for fine and coarse aggregates, as well as the computa-

tions of Concrete Mix Properties and the Physical Properties of Concrete; the design and analysis of reinforced rectangular beams, beams reinforced for compression and "T" beams. Both Tabular design and the Transformed Area methods are used in the foregoing. The principles involved in web reinforcement for diagonal tension as well as bond and shear stresses are discussed and problems worked out. Consideration is given to the interpretation of the American Concrete Institute Building Code Requirements.

(Prerequisite, 504)

3 semester hours credit

208 Concrete Design II

This course consists of the design and detailing of an interior bay of a building using one-way slabs, T-beams, and continuous girders. Composite beams and the various types of columns with both axial and eccentric loads as well as isolated and combined footings, both on soil and piles, are discussed and design problems worked out. The course concludes with a discussion and the design of retaining walls.

(Prerequisite, 207)

3 semester hours credit

209 Structural Design I

This course consists of a study of the design of such structural units as steel beams, girders, columns, trusses, riveted connections and steel frames as a whole. Particular attention is given to the practical phases of construction and their relation to design. The design of structural timber is also studied. In the first half of the year the student is given many problems which he works out at home and in class.

(Prerequisite, 214, 504)

3 semester hours credit

210 Structural Design II

The work in this course consists of designing and detailing larger and more complicated structures or portions of structures such as a plate girder, highway bridge or building frame.

(Prerequisite, 209)

3 semester hours credit

211 Water Supply

A general course in water supply engineering. The following items are studied: Future population forecasting; quality and quantity of water for various uses; rainfall; runoff; ground water and surface water collection and storage; water treatment processes such as slow and rapid sand filter, hardness, iron and other impurities removal; disinfection; and the design of distribution systems.

(Prerequisite, 204)

3 semester hours credit

212 Sewerage and Sewage Disposal

This course is concerned primarily with the collection and disposal of sewage and storm water. The following specific items are considered: Quantity of sewage and storm water; sewerage systems; collection of data necessary for the design of these systems; and a discussion of the modern methods of sewage treatment and sewage plant operation.

(Prerequisite, 204)

3 semester hours credit

213 Structural Drawing I

The course in Structural Drawing consists of making shop drawings of the various members of modern steel frames. After making drawings of structural sections and standard connections, the student is given data from which he makes framing plans and shop details using both riveted and welded construction.

(Prerequisite, 601, 602)

3 semester hours credit

214 Structural Drawing II

Using the basic information from Structural Drawing I problems in drawing and detailing portions of a steel frame building, bridge girder and roof truss are undertaken.

(Prerequisite, 213)

3 semester hours credit

ELECTRICAL ENGINEERING TECHNOLOGY**301 Direct-Current Theory**

This course is designed to give the student the required understanding of fundamental direct-current circuit theory. It deals with such concepts as electric current, electromotive force, resistivity and resistance, insulation, Ohm's law, series and parallel d-c circuits, d-c power and energy, Kirchhoff's laws, superposition and Thévenin's theorems, magnetism, magnetic fields and electromagnetic circuits, d-c instruments, and inductive and capacitive d-c transient circuits.

(Prerequisite, 701, 702)

3 semester hours credit

302 Alternating-Current Theory

In this course lectures and problems are presented dealing with fundamental alternating-current circuit theory. Involved are sinusoidal, non-sinusoidal electromotive forces and currents, vector representation of sine waves, complex and polar notation, voltage, current, impedance, admittance, power and power factor calculations for series and parallel a-c circuits, resonant conditions, network theorems, magnetically-coupled circuits, a-c instruments and elementary polyphase systems.

(Prerequisite, 301)

3 semester hours credit

303 Direct-Current Machinery

This course involves the principles of operation and testing methods of d-c machinery. It includes the consideration of shunt, series, and compound motors and generators, with emphasis on problems of commutation, armature reaction, losses, efficiencies, stray power, ratings, methods of test as well as auxiliary equipment such as protective devices. The application of d-c machinery to industry is also involved. A review of complex algebra will be given in the latter part of this course.

(Prerequisite, 301)

3 semester hours credit

304 Alternating-Current Machinery

This course involves the theory of single-phase and polyphase transformers, as well as a-c machinery. Construction and principles of opera-

tion of the constant-potential, constant-current, autotransformer, and other types of transformers are considered with emphasis on the vector diagrams, core losses and methods of test. Attention is also given to the principles of operation of the a-c induction motor, synchronous motor and alternator. The theory of operation, characteristics, load conditions and methods of testing are considered in detail.

(Prerequisite, 302, 303)

3 semester hours credit

305 Electronics for Industry

This course deals with the basic electron tubes, especially those used in industry for control purposes, as well as electronic control and regulation circuits. A study of the high-vacuum diode and triode, thyatron and phototube is made as well as amplifier theory, rectification and filtering, and general industrial control circuit application.

(Prerequisite, 302, 303)

3 semester hours credit

306 Transmission and Distribution Theory

This course is concerned with the problems pertaining to the transmission and distribution of a-c energy at power frequencies. Typical transmission-line problems are considered, involving normal and abnormal or fault conditions. The method of symmetrical components is used in the solution of certain problems. Also considered is protective and station equipment as well as trends in the power industry.

(Prerequisite, 304)

3 semester hours credit

353 Direct-Current Machinery Laboratory

This course is designed to apply the information gained from the course Direct-Current Machinery. A number of tests are performed on d-c shunt, series and compound motors as well as tests on d-c shunt and compound generators. Involved also are experiments on parallel operation of d-c generators, stray power and opposition tests.

(Prerequisite, 303 or concurrently)

3 semester hours credit

354 Alternating-Current Machinery Laboratory I

This course offers laboratory work paralleling the lectures of the course Alternating-Current Machinery and includes experiments on a-c power circuits, polyphase circuits, polyphase power measurements, constant-potential transformers, constant-current transformer, and synchronous machinery.

(Prerequisite, 304 or concurrently)

3 semester hours credit

355 Alternating-Current Machinery Laboratory II

This course includes tests on the single-phase and three-phase induction motors, the brush-shifting motor, as well as investigation of induction-motor windings, and tests on the Amplidyne generator.

(Prerequisite, 354)

3 semester hours credit

356 Electronics for Industry Laboratory

This laboratory course offers an introduction to the subject of the control and regulation of industrial equipment and processes by electronic means. Experiments are performed on the diode, triode, phototube and thyatron as well as the control of motor speed and generator voltage by electronic circuits. Available also are experiments on induction and dielectric heating, ignition three-phase rectifier and the thyatron six-tube rectifier. A portion of this laboratory will be devoted to the study of the components and operation of elementary servomechanisms.

(Prerequisite, 305)

3 semester hours credit

ELECTRONIC ENGINEERING TECHNOLOGY**401 Wave Propagation**

Designed especially for students taking the Electronic Engineering curriculum, this course deals with the fundamental principles of waves, with particular applications to electromagnetic radiation. Interference, diffraction, and polarization will be treated in detail. A considerable part of the course will be devoted to the study of antennas and the properties of the ionosphere.

(Prerequisite, 701, 702, 801, 802)

3 semester hours credit

402 Semiconductors and Transistors

This course covers the theory of semiconductors and transistors, and is about evenly divided between fundamental physics and circuits. Topics include nature of semiconductors, crystal diodes, holes and the transistor, photoelectric effect, junction transistors, electronics of transistors, circuits and circuit theory.

(Prerequisite, 301)

3 semester hours credit

403 Electrical Measurements

The successful use of modern electronic equipment in the research or development laboratory and in many operational fields requires a knowledge of the equipment and techniques employed in making precise electrical measurements. This course is intended to give the student a thorough understanding of the modern equipment and procedures used in making accurate d-c and a-c measurements of voltage, current, power, resistance, capacitance, inductance, impedance, frequency, tube characteristics, etc. Both the direct and the more accurate substitution methods are investigated. Various procedures for instrument calibration are studied. The factors limiting and controlling the precision of the results are analyzed. This lecture course provides a sound basis for future laboratory work.

(Prerequisite, 704, 301, 302)

3 semester hours credit

405 Electron Tubes and Circuits I

This course begins with a review of electron theory, then the theory of electron emission by thermionic, photoelectric, secondary and field means, including the study of the construction and processing of various types of cathodes. The construction and evacuation of tubes is discussed. The diode

tube with space charge phenomena is studied, leading to the control of electrons in vacuum tubes. The static and dynamic characteristics of various tube types are covered. Rectifier action is studied for both vacuum and gas filled tubes, together with the control of discharges in gas filled tubes. A study is made of multipurpose and special tubes, followed by the vacuum and gas tubes as control devices.

Single and polyphase rectifier circuits are studied, including choke and condenser input filters, and electronically regulated power supplies. Triodes and multigrid tubes and their equivalent amplifier circuits are discussed, followed by the cathode ray tube as a display device.

(Prerequisite, 301, 302, 704)

6 semester hours credit

406 Electron Tubes and Circuits II

This course starts with audio frequency amplifiers, first studying the voltage type and later power amplifiers. Included are the following topics: Distortion; Decibels; Input admittance; Resistance and Transformer coupling; D-c amplifiers; Photo-tube amplifiers; Current amplifiers; Volume control methods; Sources of noise; Maximum power output; Plate efficiency; Push-pull amplifiers; Classes A, AB and B operation; and Feedback amplifiers. Transistor characteristics are studied, followed by Transistor circuits as applied to small signal amplifiers. Various transistor amplifier configurations are compared and the equivalent circuits are derived.

(Prerequisite, 405)

6 semester hours credit

407 Communication Engineering I

This course opens with tuned voltage amplifiers, admittance and neutralization circuits, including grounded grid amplifiers, followed by class C and B power amplifiers, and then the study of LC oscillators, including the various feedback circuits, crystal oscillators, parasitic oscillations and special oscillator circuits. This is followed by a study of amplitude modulators, detectors and mixers, and then amplitude modulated transmitters and super-heterodyne receivers. Attention will be given to problems of selectivity, sensitivity, stability and fidelity of receivers.

(Prerequisite, 406)

6 semester hours credit

408 Communication Engineering II

This course begins with a study of wave guides and then continues with Frequency and Phase Modulation with reference to the production and detection of these types of modulation and the response of networks, and detection of F.M., P.M. waves. Then the study of Wave Shaping and Pulse Circuits is introduced, including the Multivibrator, Blocking Oscillator, Clipping and Clamping Circuits. Microwave tubes such as the Klystron, Traveling Wave Tube, Magnetrons are included. Study of Television includes Video Amplifiers, Synchronization Circuits, and Color Television. A survey of Radar and Radio aids to navigation completes this course.

(Prerequisite, 407)

6 semester hours credit

456 Electronic Laboratory

This course opens with an evening on the correct use of the test equipment used in the experiments.

The experiments in this course cover most of the subjects that have been covered by lecture in Electron Tubes and Circuits I and II. They include electron emission, gas diodes, triodes, transistor characteristics, filter circuits, iron core reactors, thyratrons, half and full wave rectifiers, voltage-regulated power supplies, voltage amplifiers, resistance coupled cascade amplifiers, feed-back amplifiers, photocells, sawtooth generators, cathode ray tubes and oscilloscopes. The use of impedance bridges and RF transmission lines is included in this course.

Laboratory reports are required on each experiment and the class is broken up into small groups so that each student has an adequate chance to participate in the experiment. A final examination is also given.

(Prerequisite, 406 or concurrently)

3 semester hours credit

457 Advanced Electronic Laboratory I

The experiments in this course cover the theory subjects studied in the Communication Engineering course and advanced audio subjects from Electron Tubes and Circuits II. They include transistorized audio amplifiers, push-pull audio amplifiers, transformer coupled audio amplifiers, narrow and wide band intermediate frequency amplifiers, detectors, distortion in audio amplifiers, video amplifiers, testing and alignment of complete radio receivers, frequency multipliers, crystal oscillators, power oscillators, audio oscillators, Class B and C RF amplifiers including neutralization, amplitude modulated RF amplifiers, balanced modulators, single side band generators, standing wave measurements, and use of Q-meters.

(Prerequisite, 407 or concurrently)

3 semester hours credit

458 Advanced Electronic Laboratory II

The experiments in this course cover the theory subjects studied in the Communication Engineering II course. They include discriminators, ratio detectors, gated beam tubes, limiters, reactance modulators, networks in FM circuits, blocking oscillators and deflection circuits, clipping and clamping circuits, frequency dividing circuits used as counters, Phantastrons and multivibrators. A complete television receiver in the form of a demonstrator is also studied for alignment, waveforms and trouble shooting, also pulse delay lines, analog computers, wave guides, slotted lines and transient circuits.

(Prerequisite, 408 or concurrently)

3 semester hours credit

MECHANICAL ENGINEERING TECHNOLOGY**501 Applied Mechanics I**

The subjects treated are collinear, parallel, concurrent, and non-concurrent force systems in a plane; the determination of the resultant

of such systems by both algebraic and graphical means, the forces required to produce equilibrium in such systems; stresses in trusses and frames.

(Prerequisite, 701, 702, 801)

3 semester hours credit

502 Applied Mechanics II

A continuation of Applied Mechanics I in which the subjects treated are problems involving static friction, such as the inclined plane and the wedge; force systems in space; first moments as applied to the determination of centers of gravity of areas and solids; second moments and the application to the determination of moments of inertia of plane and solid figures, radius of gyration, polar moment of inertia, product of inertia.

(Prerequisite, 501)

3 semester hours credit

503 Strength of Materials I

This course comprises the study of the stresses and strains in bodies subjected to tension, compression, and shear; mechanical properties of materials; special cases of stress due to axial loads; shear and bending moment in beams; a study of the common theory of beams with description of the stress distribution; design of beams.

(Prerequisite, 501, 502, 704)

3 semester hours credit

504 Strength of Materials II

This is a continuation of Strength of Materials I and includes the consideration of the deflection of statically determinate beams; the strength of shafting and springs due to torsional stress; combined stresses in members due to compression, tension and bending; riveted and welded joints; thin hollow cylinders; columns, and brief consideration of strains and the relation of the stresses on different planes in a body.

(Prerequisite, 503)

3 semester hours credit

505 Heat Engineering I

The purpose of the course is to familiarize the student with the theory of heat as applied to prime movers.

The fundamentals of thermodynamics are discussed in this course and include the general theory of heat and matter; first and second laws of thermodynamics; equations of state; fundamental equations of thermodynamics; laws of perfect gases; properties of vapors including use of tables and charts; and the general equation for the flow of fluids. Particular emphasis is given to the properties of steam, the use of the steam tables, and the Mollier diagram.

Included in this course is a study of fuels and combustion of fuels as applied to steam boilers. Steam generators and auxiliaries are discussed as well. A large number of problems related to the apparatus considered are solved.

(Prerequisite, 701, 702, 801, 802)

3 semester hours credit

506 Heat Engineering II

This course is a continuation of Heat Engineering I and includes the descriptions of the many kinds of apparatus used in the steam power plant such as steam engines, turbines and auxiliary equipment, including

pumps, condensers, heaters, fans, etc. In addition to the above, such items as draft, chimneys, coal and ash handling equipment, piping and valves as well as power plant layouts are studied. Besides the study of steam apparatus, air compressors, internal combustion engines, gas turbines and refrigeration are briefly considered. Problems related to the above equipment are solved.

(Prerequisite, 505)

3 semester hours credit

507 Mechanism

Study of displacement, velocity and acceleration of basic mechanisms employed in machine design. Analysis and design of cams, rolling contact drives and linkages. Theory of gear tooth design. Properties and limitations of involute gears. Design of simple and epicyclic gear trains. Analog computer analysis.

(Prerequisite, 501, 502, 603, 604)

3 semester hours credit

508 Machine Design I

The first semester course in Machine Design consists of the following topics: Materials and their properties; stress analysis, dynamic stresses and stress concentration; stresses in long and short columns such as connecting rods and links, fatigue of metals and endurance diagrams as used in reversed stresses; general manufacturing considerations; design of weldments.

(Prerequisite, 504)

3 semester hours credit

509 Machine Design II

The second semester consists mainly of the following: Riveting as applied to machine elements; design of screw fastenings; keys, pins and cotters; press, shrink and friction joints; flat, helical and torsion springs; cylinder heads and cover plates; brakes, flywheel design, gearing.

(Prerequisite, 508)

3 semester hours credit

551 Mechanical Engineering Laboratory I

This course includes a series of experiments upon various kinds of equipment to demonstrate under actual conditions the principles developed in several courses. Tests on instrumentation, flow measurement, hydraulic machinery, stationary steam and internal combustion engines and simple testing of materials are performed. A report on the results obtained from the test and comparisons between related equipment is written for each experiment.

(Prerequisite, 504, 506)

3 semester hours credit

552 Mechanical Engineering Laboratory II

This course is a continuation of Mechanical Engineering Laboratory I with a series of experiments upon more advanced types of equipment. Tests are run on heating, refrigerating and air conditioning equipment, additional steam and internal combustion engines having a greater number of possible variables, and various materials of construction.

(Prerequisite, 551)

3 semester hours credit

DRAWING

601 Engineering Drawing I

This course is planned to meet the requirements of a class composed of students who have had no previous instruction in drafting, and also for those who may have had one or two years' work in preparatory schools.

Solutions are required for both class and home assignments. The topics studied in these assignments include technique practice, lettering, geometric constructions, orthographic projections and auxiliary views.

A lecture is given at the opening of each class and individual instruction is given during the remainder of the class period.

3 semester hours credit

602 Engineering Drawing II

This course is a continuation of Engineering Drawing I. Solutions are required for both class and home assignments. The topics studied in these assignments include development of objects, isometric, cavalier and cabinet drawing, intersections, sections, helix and application, screw threads, dimensions and inking. A number of practical problems are included which relate to future professional courses.

A lecture is given at the opening of each class, and individual instruction is given during the remainder of the class period. The work in courses Engineering Drawing I and II is planned to give the student a thorough training in the fundamental principles of Engineering Drawing so that he may easily do the drafting required in his professional course.

(Prerequisite, 601)

3 semester hours credit

603 Machine Drawing I

This course is conducted on a lecture-laboratory basis with the student working out problems under supervision. The fundamental principles representing the shape and specifying the size of such machine elements as castings, forgings, fabricated weldings, etc., are taught. The mediums used are multi-view orthographic projection, auxiliary and sectional views, along with the appropriate dimensioning techniques. Lectures and reading assignments are correlated with the classroom problems and cover such topics as the drawing techniques applicable to the particular study, American Standard drafting-room practices, methods and materials of machine production, fractional and decimal dimensioning systems, fasteners, bearings, lubrication, stamping, methods of reproduction, etc.

The types of drawings made and analyzed include preliminary machine sketches and assemblies, dimensioned detail working drawings from machine assemblies and assembly drawings from machine details.

(Prerequisite, 601, 602)

3 semester hours credit

604 Machine Drawing II

This course begins with belt drives, spur, rack, internal, worm and bevel gears. These are followed by plate, face and cylindrical cams. Other subjects include piping, clutches, couplings, jigs, fixtures and die casting. The last half of this course is devoted to design layouts of a simple jig, stamping machine and reducing gear box.

(Prerequisite, 603)

3 semester hours credit

MATHEMATICS**700 Pre-Engineering Mathematics**

This course is devoted to a thorough study of Algebra I and Plane Geometry.

701 Algebra

Although the primary purpose of this course is to lay a thorough groundwork for the subsequent courses in Analytical Geometry, Calculus, and Applied Mechanics, it is nevertheless a complete unit in itself, and will enable the student to handle a considerable number of the problems arising in engineering practice.

Proceeding from a rapid review of the fundamental operations of Algebra, the work continues with a thorough study of fractions, functions, linear and quadratic equations, equations in quadratic form, graphs, exponents, complex numbers, binomial expansion, variation, and equations of higher degree than the second.

(Prerequisite, 700 or Mathematics Placement Test)

3 semester hours credit

702 Trigonometry

This course includes the solution of all triangles by both natural and logarithmic functions, identities, radian measure, principal values and the solution of trigonometric equations. Particular attention is given to the applications of Trigonometry to engineering practice.

(Prerequisite, 701)

3 semester hours credit

703 Analytic Geometry and Differential Calculus

This course provides a smooth transition from algebra and trigonometry into the Calculus. Included are the studies of the straight line, the circle, and conic sections, using rectangular coordinates only. The graphs of trigonometric, logarithmic, and exponential functions are also covered. Then follows the differentiation of algebraic and transcendental functions, both explicit and implicit, with some applications. Slopes of curves, maxima and minima, derivatives of higher order, velocity and acceleration in rectilinear motion are included.

(Prerequisite, 701, 702)

3 semester hours credit

704 Integral Calculus

This course deals with integration as the inverse of differentiation as well as the limit of summation. The topics covered are methods of integration; use of integral tables; differential equations with separable variables; the differential equation of rectilinear motion; definite integrals; areas in rectangular coordinates; length of curves; areas of surfaces of revolution; volumes of solids of revolution; multiple definite (iterated) integrals; centroids of plane areas; moment of inertia.

(Prerequisite, 703)

3 semester hours credit

PHYSICS**801 Physics I**

This course covers the principles of mechanics. Among the topics covered are force; energy; work; statics; elasticity; linear, rotational and harmonic motion; liquids and gases.

Each lecture is followed by a demonstration period and a problem period in which the student learns the practical application of the physical laws being studied.

(Prerequisite, 701, 702 or concurrently)

3 semester hours credit

802 Physics II

This course includes a study of wave motion, sound, heat, light and electricity. The section in heat involves thermometry, expansion, calorimetry, behavior of gases, vaporization and transfer of heat. Under the subject of light are reflection, refraction, dispersion, diffraction and interference, lenses, and optical instruments. The study of electricity includes magnetism, electrostatics, resistance, capacitance, inductance, alternating currents, and series and parallel circuits.

As in course Physics I each lecture is followed by both a demonstration period and a problem period.

(Prerequisite, 801, 702 or concurrently)

3 semester hours credit

NORTHEASTERN UNIVERSITY

THE LINCOLN INSTITUTE

360 Huntington Avenue

Boston 15, Massachusetts

To the Dean:

.....19.....

I (First name) (Middle name) (Last name) hereby apply for admission to the Lincoln Institute in the term beginning in (Sept.—Jan.—June) and submit the following information:

..... (Street address) (Town) (State) (Phone)
 Age Date of Birth Married ☐ Single ☐
 Citizen of U. S. Yes ☐ No ☐

Name of your employer Nature of your employment
 Business address Business telephone

I have attended, including other schools of the Northeastern University system, the following schools above grammar grade (if attendance at a university, *designate school*):

NAME OF SCHOOL	LOCATION — CITY, STATE	Clk. Yrs. Attended				Date Left	Date of Graduation	Degree if any
		1	2	3	4			

I request advanced standing credit for previous college work completed at (name of institution) I shall furnish transcript.
 (OVER)

I wish to enroll for the following:

- ☐ Curriculum leading to the Degree of Bachelor of Science in Industrial Technology.
- ☐ Curriculum leading to the Degree of Associate in Engineering or Science.
- ☐ I do not wish to pursue a complete curriculum but, as a special student, wish to enroll in the following courses:
.....

As part of the program checked above, I wish to elect the following major:

- ☐ CHEMISTRY
- ☐ CIVIL ENGINEERING TECHNOLOGY
- ☐ ELECTRICAL ENGINEERING TECHNOLOGY
- ☐ I wish to take the Pre-Engineering program with the major checked above.

Please answer the following questions:

- Have you passed a course in First Year Algebra? If so, give approximate year
- Have you passed a course in Plane Geometry? If so, give approximate year
- Are you to take these courses under the Veterans Administration? Yes ☐ If Yes ☐ Korean War (P.L. 550)
No ☐ Other ☐ (Specify)

Application Accepted by

.....
Signature of Student.

NORTHEASTERN UNIVERSITY

THE COLLEGE OF LIBERAL ARTS

Offers full-time day curricula on the Co-operative Plan leading to the degrees of Bachelor of Arts and Bachelor of Science; part-time evening programs available leading to the degree of Bachelor of Arts.

THE COLLEGE OF EDUCATION

Offers full-time day curricula on the Co-operative Plan leading to the degree of Bachelor of Science in Education in preparation for teaching in elementary or secondary schools; part-time evening program also available in co-operation with the College of Liberal Arts.

THE COLLEGE OF BUSINESS ADMINISTRATION

Offers full-time day curricula on the Co-operative Plan and part-time evening programs, both leading to the degree of Bachelor of Science in Business Administration.

THE COLLEGE OF ENGINEERING

Offers full-time day curricula on the Co-operative Plan and part-time evening programs, both leading to the degree of Bachelor of Science in Engineering.

UNIVERSITY COLLEGE

Offers part-time evening programs of adult education designed especially to meet the needs of employed personnel and leading to the Bachelor of Science degree with course specification or to appropriate associate degrees.

THE LINCOLN INSTITUTE

Offers part-time evening curricula in science and in engineering technology leading to the degrees of Associate in Science and Associate in Engineering.

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Business — Offers evening programs leading to the degree of Master of Business Administration.

Education — Offers evening and Saturday morning programs leading to the degree of Master of Education.

Engineering — Offers day and evening programs leading to the degree of Master of Science with course specification.

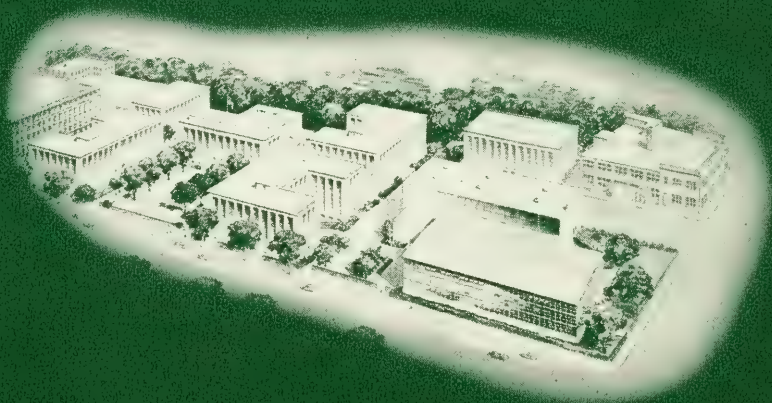
All Programs Are Open to Both Men and Women

For further information

regarding any of the above schools or colleges, address

DR. GILBERT C. GARLAND, *Dean and Director of Admissions*

360 Huntington Avenue, Boston 15, Massachusetts, COpley 7-6600



NORTHEASTERN UNIVERSITY
GRADUATE SCHOOL

PROGRAMS IN
ARTS AND SCIENCES

CATALOGUE 1960-1961



BOSTON 15, MASSACHUSETTS

APRIL 1960

INTERVIEW PERIODS and REGULAR SESSIONS

1960 Summer Session

Interview Period	May 23-June 4
Registration Period	May 23-June 4
Regular Session	June 6-July 29

1960-61 First Semester

Interview Period	Aug. 22-Sept. 10
Registration Period	Aug. 22-Sept. 10
Regular Session	Sept. 12-Jan. 20

1960-61 Second Semester

Interview Period	Jan. 9-Jan. 28
Registration Period	Jan. 9-Jan. 28
Regular Session	Jan. 30-May 26

1961 Summer Session

Interview Period	May 22-June 3
Registration Period	May 22-June 3
Regular Session	June 5-July 28

REGULAR OFFICE HOURS

Monday through Friday	8:45 a.m.- 5:00 p.m.
Saturday	8:45 a.m.-12:00 noon

SPECIAL OFFICE HOURS DURING REGISTRATION PERIODS ONLY

Monday through Friday	8:45 a.m.- 8:00 p.m.
Saturday	9:00 a.m.-12:00 noon

The office is closed on all legal holidays.

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DEAN OF THE GRADUATE SCHOOL

Northeastern University

360 Huntington Avenue, Boston 15, Massachusetts

Copley 7-6600

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GRADUATE SCHOOL

PROGRAMS IN
ARTS AND SCIENCES

CATALOGUE 1960-1961



LEADING TO THE DEGREES OF
MASTER OF SCIENCE AND MASTER OF ARTS

BOSTON 15, MASSACHUSETTS

APRIL 1960

GRADUATE PROGRAMS

AT

NORTHEASTERN UNIVERSITY



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Teaching Fellow Programs leading to a Master of Science or a Master of Arts degree in the fields of Chemistry, English, History, Government, Physics, and Psychology.

Evening Programs in Chemistry, Mathematics, and Physics, leading to the Master of Science degree.

BUSINESS ADMINISTRATION

Teaching Fellow Programs in Accounting leading to the Master of Business Administration degree.

Evening Programs leading to the Master of Business Administration degree.

EDUCATION

Late Afternoon, Evening, and Saturday Morning Programs leading to the Master of Education degree.

ENGINEERING

Co-operative Programs leading to the Master of Science degree in Chemical Engineering, in Civil Engineering with a major in Structures, in Mechanical Engineering with a major in Mechanics, and in Electrical Engineering.

Evening Programs leading to a Master of Science degree in Civil Engineering, Electrical Engineering, Communications, Engineering Management, Engineering Mechanics, and Mechanical Engineering.

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ACADEMIC CALENDAR

MAY 1960 - JUNE 1961

SUMMER SESSION 1960

Interview and Registration Period	Monday-Saturday	May 23-June 4
Memorial Day, Office Closed	Monday	May 30
Classes Begin	Monday	June 6
Independence Day, No Classes	Monday	July 4
Classes End	Tuesday	July 26
Examination Period	Wednesday-Thursday	July 27-July 28

FIRST SEMESTER 1960-1961

Interview and Registration Period	Monday-Saturday	Aug. 22-Sept. 10
Labor Day, Office Closed	Monday	Sept. 5
Classes Begin	Monday	Sept. 12
Columbus Day, No Classes	Wednesday	Oct. 12
Veterans' Day, No Classes	Friday	Nov. 11
Thanksgiving Vacation	One Week	Nov. 21-Nov. 28
Classes Resume	Monday	Nov. 28
Christmas Vacation	Two Weeks	Dec. 20-Jan. 2
Classes Resume	Tuesday	Jan. 3
Classes End	Friday	Jan. 13
Examination Period	Monday-Friday	Jan. 16-Jan. 20
No Classes	Monday-Friday	Jan. 23-Jan. 27

SECOND SEMESTER 1960-1961

Interview and Registration Period	Monday-Saturday	Jan. 9-Jan. 28
Classes Begin	Monday	Jan. 30
Washington's Birthday, No Classes	Wednesday	Feb. 22
Patriots' Day, No Classes	Wednesday	April 19
Classes End	Friday	May 12
Make-up for Classes Missed Wed., April 19	Wednesday	May 17
Examination Period	Monday-Friday	May 22-May 27

CALENDAR

APRIL 1, 1960 - JUNE 30, 1961

1960

APRIL

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1961

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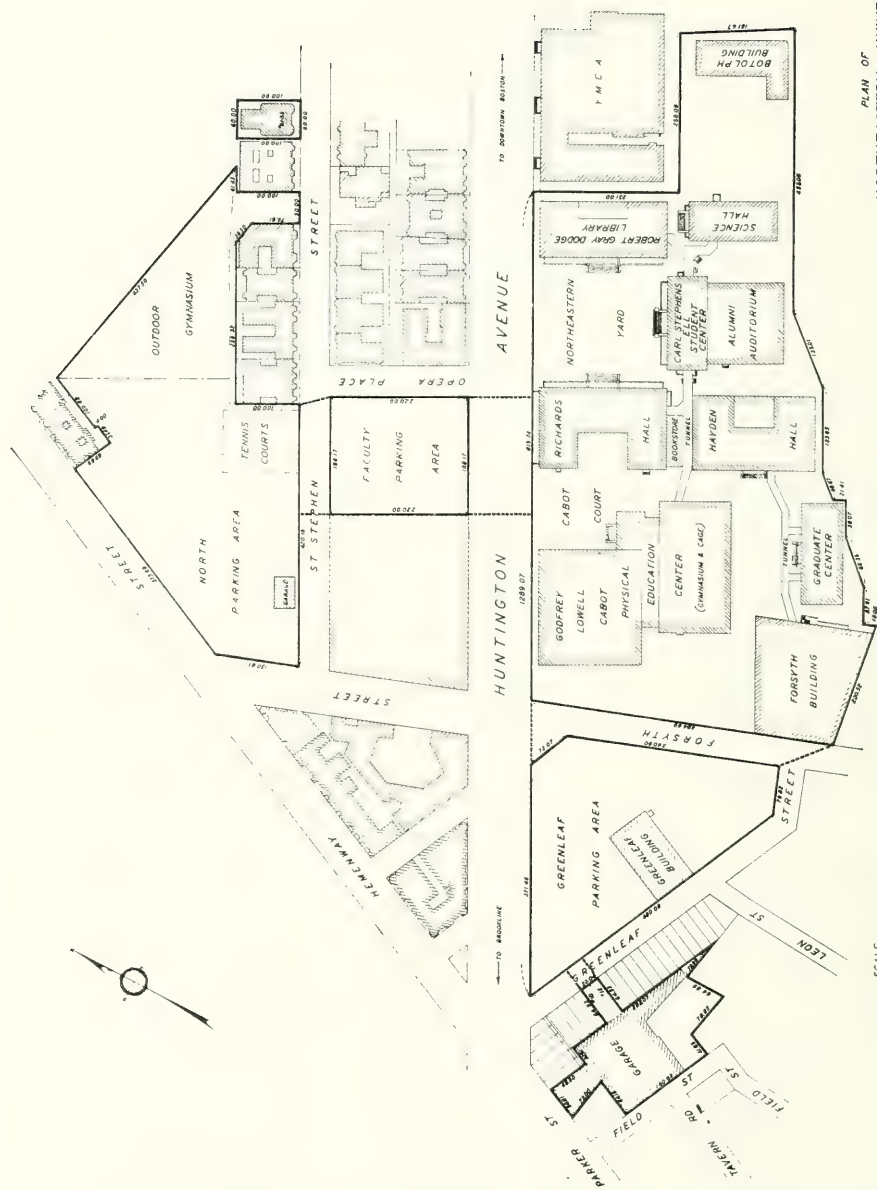
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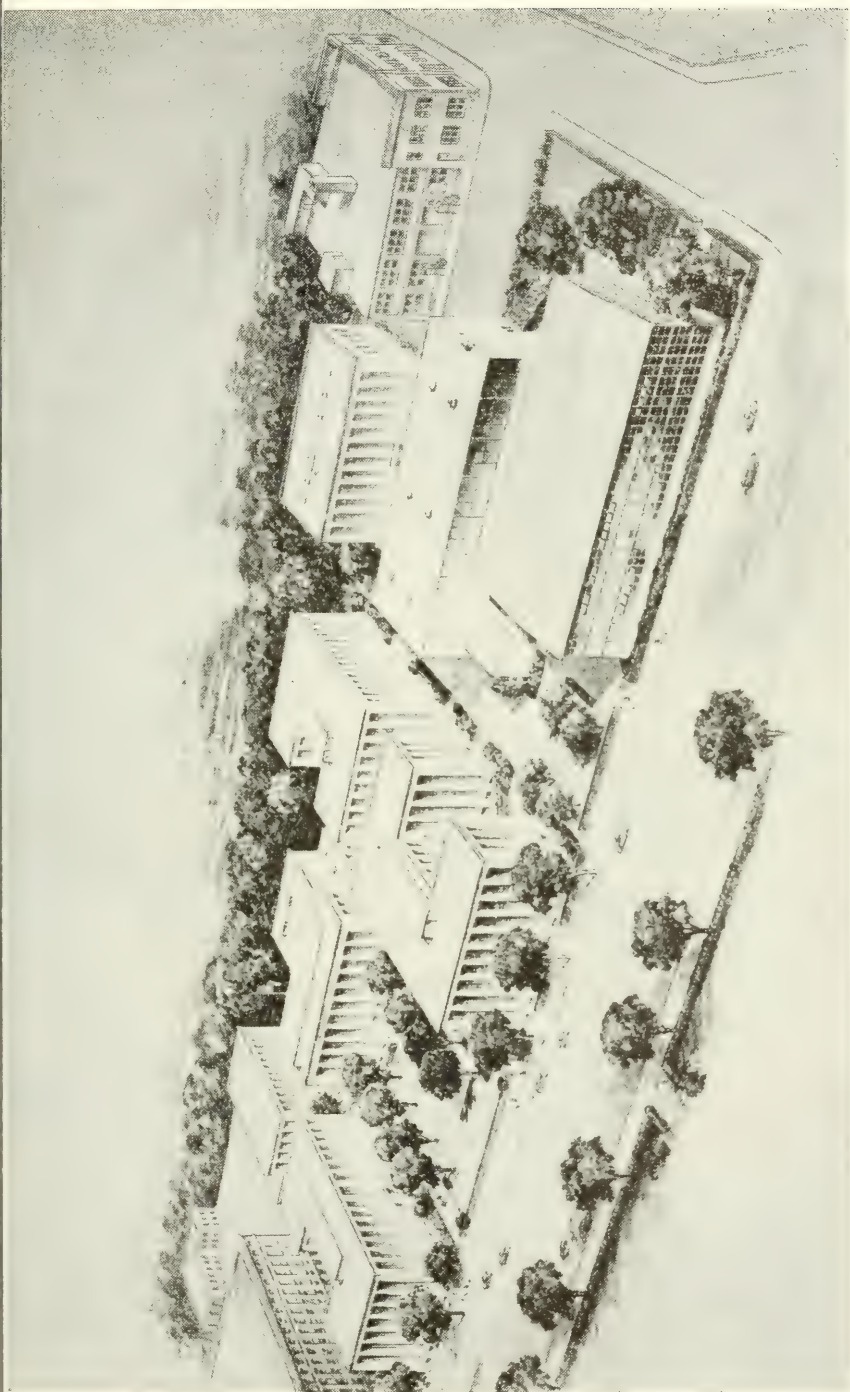
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GILBERT G. MACDONALD, B.I.E., Ed.M.	<i>Dean of Students</i>
DOROTHY G. DISSELL, B.A., M.A., Ph.D.	<i>Dean of Women</i>
CHRISTOPHER F. KENNEDY, A.B., Ed.M.	<i>Dean of Freshmen</i>
CHARLES W. HAVICE, A.B., M.A., S.T.B., Ph.D., D.D.	<i>Dean of Chapel</i>
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ROLAND H. MOODY, A.B., B.L.S.	<i>Director of University Libraries</i>
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PHILIP W. PENDLETON, B.A., M.A., Ph.D.	<i>Director of Testing and Counseling Center</i>
RUDOLF O. OBERG, S.B., Ed.M.	<i>Director of Alumni Relations</i>
GEORGE A. SPEERS, A.B., M.S., Ed.M.	<i>Director of Press Bureau</i>
DESCOMB T. STEWART, A.B.	<i>Editor and Director of Office of University Publications</i>
J. KENNETH STEVENSON, B.C.S.	<i>Superintendent of Buildings and Grounds</i>
WILLIAM M. STEWART, B.S.	<i>Manager of the Bookstore</i>
RICHARD E. SPRAGUE, S.B., B.B.A., M.B.A., Ed.M.	<i>Secretary of the Faculty</i>
DANIEL J. ROBERTS, JR., S.B., M.B.A., Ed.M.	<i>Bursar</i>

THE GRADUATE SCHOOL

ARTHUR ANDREW VERNON, S.B., M.S., Ph.D.	<i>Dean of the Graduate School</i>
EMIL ANTON GRAMSTORFF, S.B., M.S.	<i>Dean of Graduate Study in Engineering</i>
GEORGE WILLIAM HANKINSON, A.B., S.B., M.S.	<i>Assistant Dean of Graduate Study in Engineering</i>
MYRON JAY SPENCER, A.B., M.A.	<i>Director of Graduate Study in Business Administration</i>
LESTER SETH VANDER WERF, A.B., M.A., Ed.D.	<i>Dean of College of Education, Director of Graduate Study in Education</i>
JANICE WALKER, A.B.	<i>Registrar of the Graduate School</i>
CHARLES MICHAEL DEVLIN, B.S.	<i>Administrative Assistant</i>

University Advisory Committee on Graduate School Policy

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	<i>Registrar of the Graduate School</i>
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BARKEV KIBARIAN, B.S., M.B.A., Ph.D.	<i>Assistant Professor of Marketing and Advertising</i>
GIOVANNI LANZA, Ph.D.	<i>Associate Professor of Physics</i>
ROBERT ANDREWS SHEPARD, B.S., Ph.D.	<i>Professor of Chemistry and Chairman of the Department</i>
MYRON JAY SPENCER, A.B., M.A.	<i>Director of Graduate Study in Business Administration and Professor of Economics</i>
RALPH ANDERSON TROUPE, B.S., M.S., Ph.D.	<i>Research Professor of Chemical Engineering</i>

LESTER SETH VANDER WERF, A.B., M.A., Ed.D.

Dean of College of Education and Director of Graduate Study in Education

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Vice-President and Provost of the University

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Professor of Finance and Chairman of the Department

ASA SMALLIDGE KNOWLES, A.B., A.M., LL.D. (*ex officio*)

President of the University

Committee on Graduate Study in Arts and Sciences

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Dean of the Graduate School and Professor of Chemistry

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Professor of History and Chairman of the Department

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Professor of English and Chairman of the Department

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FRANKLIN NORVISH, B.S., M.A.

Associate Professor of English

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Associate Professor of History and Dean of Administration

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Professor of Chemistry and Chairman of the Department

HAROLD LEROY STUBBS, A.B., M.A., Ph.D.

Professor of Mathematics

A. BERTRAND WARREN, A.B., M.A., Ph.D.

Professor of Psychology and Chairman of the Department

WILLIAM CROMBIE WHITE, S.B., Ed.M., Eng.D.

Vice-President and Provost of the University

R. GREGG WILFONG, A.B., M.A.

Associate Professor of Government and Chairman of the Department

TEACHING STAFF

The teaching staff of the Graduate Arts and Sciences Programs is composed of regular full-time faculty members of Northeastern University, members of the faculties of neighboring institutions, and private engineers and scientists. The composition of the teaching staff during any particular school year is dependent upon the courses offered during that year. The teaching staff of the Graduate Arts and Sciences programs includes the following:

CHARLES O. AHONEN	<i>Professor of Physics, Merrimack College</i>
EDWARD R. ATKINSON	<i>Arthur D. Little, Inc.</i>
DAVID W. BARKLEY	<i>Assistant Professor of Government, Northeastern University</i>
IRWIN S. BERNSTEIN	<i>Senior Scientist, Avco Mfg. Corp.</i>
EUGENE J. BLACKMAN	<i>Assoc. Prof. of English, Northeastern University</i>
EDWARD M. COOK	<i>Assoc. Prof. of Mathematics, Northeastern University</i>
ELMER H. CUTTS	<i>Professor of History, Northeastern University</i>
PHILIP DAVIS	<i>Staff Member, Lincoln Lab., Mass. Inst. of Technology</i>
JOHN DROUGAS	<i>Chemist, Arthur D. Little, Inc.</i>
LEONARD G. EYGES	<i>Div. Leader, Theoretical Physics, Lincoln Lab., Mass. Inst. of Technology</i>
VICTOR S. FRANK	<i>Manager, Organic Chem. Research, Dewey and Almy Chemical Company</i>
ARTHUR J. FREEMAN	<i>Research Physicist, Watertown Arsenal</i>
ROYAL M. FRYE	<i>Professor of Physics, Merrimack College</i>
NORBERT L. FULLINGTON	<i>Assistant Professor of History, Northeastern University</i>
SAMUEL M. GIVEEN	<i>Assistant Professor of Mathematics, Northeastern University</i>
RICHARD E. GROJEAN	<i>Asst. Prof. of Physics, Northeastern University</i>
WALTER HAUSER	<i>Staff Member, Lincoln Lab., Massachusetts Institute of Technology</i>

FRANCIS B. HILDEBRAND	<i>Assoc. Prof. of Mathematics, Mass. Inst. of Technology</i>
FREDERICK W. HOLMES	<i>Professor of English, Northeastern University</i>
DAVID M. HOWELL	<i>Assoc. Prof. of Chemistry, Northeastern University</i>
ALBERT D. JOHNSON	<i>Research Physicist, Air Force Cambridge Research Center</i>
NELSON H. KEMP	<i>Senior Scientist, Research Lab., Avco Mfg. Corp.</i>
GEORGE KHIRALLA	<i>Asst. Professor of English, Northeastern University</i>
ROBERT D. KLEIN	<i>Research Associate, Northeastern University</i>
GIOVANNI LANZA	<i>Assoc. Prof. of Physics, Northeastern University</i>
LEONARD LESENSKY	<i>Physicist, Raytheon Company</i>
EVERETT C. MARSTON	<i>Professor of English, Northeastern University</i>
NATHAN G. PARKE, III	<i>President Parke Mathematical Laboratories, Inc.</i>
STEFAN PETERS	<i>Consulting Actuary</i>
JOHN R. REES	<i>Research Fellow in Physics, Harvard University</i>
SUMNER M. ROSEN	<i>Asst. Prof. of Economics, Northeastern University</i>
NORMAN ROSENBLATT	<i>Asst. Prof. of History, Northeastern University</i>
LAWRENCE ROSENFELD	<i>Director of Research, The Rusan Corp.</i>
EDWARD W. ROSS	<i>Head of Math. Sec., Watertown Arsenal Laboratory</i>
ABRAHAM SPECTOR	<i>Howe Laboratory of Ophthalmology, Massachusetts General Hospital</i>
VICTOR R. STAKNIS	<i>Assoc. Prof. of Mathematics, Northeastern University</i>
TIEN-FAN TAO	<i>Teaching Fellow, Harvard University</i>
RICHARD J. TURYN	<i>Adv. Research Eng., Sylvania Electric Products, Inc.</i>
ROCCO H. URBANO	<i>Mathematician, Air Force Cambridge Research Center</i>
ALFRED VIOLA	<i>Asst. Prof. of Chemistry, Northeastern University</i>
IRVING WEISS	<i>Statistician, The Mitre Corporation</i>
ROBERT N. WIENER	<i>Asst. Prof. of Chemistry, Northeastern University</i>
R. GREGG WILFONG	<i>Assoc. Prof. of Government, Northeastern University</i>
ARTHUR WOUK	<i>Senior Engineer, Sylvania Electric Products, Inc.</i>
HUSEYIN YILMAZ	<i>Senior Research Staff, Sylvania Electric Prod., Inc.</i>

NORTHEASTERN UNIVERSITY

GENERAL INFORMATION

Northeastern University is incorporated as a philanthropic institution under the General Laws of Massachusetts. The State Legislature, by special enactment, has given the University general degree granting powers.

The Corporation of Northeastern University consists of men who occupy responsible positions in business and the professions. This Corporation elects from its membership a Board of Trustees in whom the control of the institution is vested. The Board of Trustees has four standing committees: (a) an Executive Committee which has general supervision of the financial and educational policies of the University; (b) a Committee on Buildings which has general supervision over the building needs of the University; (c) a Committee on Funds and Investments which has the responsibility of administering the funds of the University; (d) a Committee on Development which is concerned with furthering the development plans of the University.

Founded in 1898, Northeastern University, from its beginning, has had as its dominant purpose the discovery of human and social needs and the meeting of these needs in distinctive and highly serviceable ways. While subscribing to the most progressive educational thought and practice, the University has not duplicated the programs of other institutions but has sought "to bring education more directly into the service of human needs."

UNDERGRADUATE PROGRAMS

The College of Liberal Arts offers majors in the usual fields of the arts and sciences leading to the degrees of Bachelor of Arts and Bachelor of Science. With the exception of pre-professional programs, day curricula are normally five years in length and operated on the Co-operative Plan. However, in all majors except Chemistry and Physics, qualified students, with the approval of the Dean, may elect to complete the requirements for the degree on a full-time plan in four years.

The College of Liberal Arts offers certain of its courses during evening hours, constituting a program of three years' duration equivalent in hours to one-half the requirements for the A.B. or S.B. degree. The degree of Associate in Arts is conferred upon those who complete this program. A complete A.B. program is also offered in the evening division with curricula in Economics, History and Government, and Sociology.

The College of Education offers the option of study on the conventional four-year full-time plan or on the five-year Co-operative Plan. Both programs lead to the degree of Bachelor of Science in Education. These are designed particularly to meet the needs of high school graduates who desire to prepare themselves for teaching and administrative positions in elementary and secondary schools.

The College of Business Administration offers five-year co-operative curricula in Accounting, Business Management, Finance and Insurance, Industrial Relations, and Marketing and Advertising leading to the degree of Bachelor of Science in Business Administration.

The School of Business — operated during evening hours — offers undergraduate curricula leading to the degree of Bachelor of Business Administration in Accounting, Management, Law and Business, Engineering and Management, Liberal Arts and Business. For students who because of occupational reasons desire shorter programs concentrating in specific areas, Institutes awarding the certificate are offered in various fields.

The College of Engineering offers five-year co-operative curricula in Civil, Mechanical, Electrical, Chemical, and Industrial Engineering leading to the degree of Bachelor of Science with specification according to the department in which the student qualifies.

GRADUATE PROGRAMS

Graduate work was started for teaching fellows in 1940 and has since expanded into six departments.

In response to a need for evening work on the graduate level, course work in certain engineering areas was started in 1948. This program

developed rapidly, and at present evening programs leading to the Master of Science degree are given in seven engineering and science departments. A co-operative graduate program in engineering was started in 1956, and at present degrees from this plan of study are offered by four engineering departments.

The evening graduate work was expanded in 1951 by a program leading to the Master of Business Administration degree; in 1953 a similar program was initiated to allow students to earn a Master of Education degree in late-afternoon or evening classes.

The teaching fellow programs enable graduate students to further their academic training while they obtain valuable experience in teaching. The evening programs are designed for those who wish to carry on advanced study on a part-time basis while continuing their regular employment. In the co-operative programs students alternate work periods with study periods so that industrial experience can be obtained along with advanced academic training. The courses in all programs have been designed to give penetrating understanding of fundamentals as well as a breadth of knowledge in allied fields.

BUILDINGS AND FACILITIES

LOCATION

Northeastern University is located on Huntington Avenue in the Back Bay section of Boston. The main administrative offices of the University are located in Richards Hall.

The chief railroad centers of Boston are the North and South Stations. To reach the University from the North Station, board an MTA subway car going to Park Street and transfer there to any Huntington Avenue car. To reach the University from the South Station, board a Cambridge-bound subway train and transfer at Park Street to a Huntington Avenue car. The "Northeastern" station is the first stop outside the subway.

HUNTINGTON AVENUE CAMPUS

The principal educational buildings of Northeastern University are located on a sixteen-acre site in the Back Bay section of Boston. Only one block to the west of the University lie the famous Boston Museum of Fine Arts and the beautiful public gardens-park reservation known as "The Fenway."

Following a long-range development plan, University facilities have expanded substantially in recent years. In addition to the six buildings constructed within the last two decades, several modernized older buildings are available for specialized uses. The newer buildings on the campus are interconnected by means of tunnels, so that the students may go from building to building without going out of doors in inclement weather. All of the buildings are used in common by the students of the four colleges.

In addition to classrooms and instructional offices, the principal buildings include the following:

Botolph Building — Civil Engineering Laboratories

Cabot Physical Education Center — Gymnasium, Cage, Rifle Range

Dodge Library — Library, Drawing Rooms

Ell Student Center — Student Activities, Health Department, Chapel, Auditorium, and University Commons

Forsyth Building — Industrial and Mechanical Engineering Laboratories

Graduate Center — Administrative Offices of the Graduate School, Physics Laboratories, and Cafeteria.

Greenleaf Building — ROTC Headquarters, Research Facilities

Hayden Hall — Offices of the University College, Business, Education, and Electrical Engineering Laboratories, Art Studio

Richards Hall — Administrative Offices, Mechanical Engineering, Psychology and Chemistry Laboratories, Bookstore

Science Hall — Chemical Engineering and Biology Laboratories

Graduate School Regulations

GRADUATE SCHOOL REGULATIONS

TEACHING FELLOW PROGRAMS

ADMISSION

A limited number of graduate students are enrolled in Teaching Fellowship Programs in Chemistry, English, Government, History, Physics, and Psychology. Two years are needed for completion of the requirements for the degree under these programs.

The admission requirements are given under the departmental headings; in general, applicants must show an ability to profit from graduate work. Transcripts and letters of recommendation must be filed with the application by March 15 of the year in which graduate work is to be started. Applications must be made on forms secured from the Dean of the Graduate School.

REGISTRATION

At the beginning of each semester, all students must register in the Graduate School office.

FEES

A diploma fee of \$20 is payable one month before the date at which the degree is to be awarded.

REQUIREMENTS FOR THE DEGREES OF MASTER OF SCIENCE AND MASTER OF ARTS

A total of thirty semester hours of course work, including a thesis, is required. A minimum of twenty credits must be taken in the field of concentration.

Foreign language and comprehensive examination requirements are at the option of the department.

THESIS

The regulations concerning the forms of the thesis may be obtained from the Graduate School office or the head of the department concerned.

SCHOLASTIC PERFORMANCE

Each student must maintain a standard of performance acceptable to the Committee on Graduate Study in Arts and Sciences.

EVENING PROGRAM

ADMISSION

For admission to the Evening Graduate Program, applicants must have a bachelor's degree from an accredited program in the appropriate field. A personal interview with the Dean of the Graduate School is required of all students wishing to enter any of the programs. A transcript of the applicant's prior college training should be presented at that time; if this is not possible, such material should be filed within six weeks after registration. No second registration will be allowed, nor will any grades of courses taken in the first registration period be issued until a transcript has been received and reviewed.

REGISTRATION

At the beginning of each semester, all students must register in the Graduate School office at the times indicated on the calendar.

Students in the evening part-time program, after a review of their transcript, will be classified as regular or special.

Regular Students: Students who have a bachelor's degree from an accredited program with acceptable quality of undergraduate work are designated as Regular Students.

Special Students: Students whose undergraduate record is not acceptable for regular classification are designated as Special Students.

DEGREE CANDIDACY

Admission to a course or courses does not constitute acceptance as a candidate for a master's degree.

A student who has achieved regular classification and who has completed twelve credits of required courses in his major with a grade of B will be admitted to degree candidacy.

REQUIREMENTS FOR THE DEGREE OF MASTER OF SCIENCE AND MASTER OF ARTS

Thirty semester hours of course work are required for the degree of Master of Science or Master of Arts. The programs of required and elective courses are given in a later section.

To make an effective total program, the selection of elective courses may be one of penetration and specialization in a given field, or it may be one cutting across related fields giving supporting breadth to the student's education. Department heads and the Dean of the Graduate School are readily available for counsel in the selection of electives. In every case, the student must be able to comply with the prerequisites or preparation requirements of his course selections.

STUDY LOAD

All graduate students are limited to a program of four semester hours of course work per semester unless granted special permission by the Committee on Graduate Study in Arts and Sciences to carry a heavier course load. Thus, those who carry two evenings a week (four semester hours of course work) continuously for both semesters may complete the requirements of thirty semester hours for the degree within four years. Some students may find it possible to shorten this period to three years by enrolling in the Summer Sessions.

GRADING SYSTEM

The performance of students in graduate courses will be recorded by the instructor by use of the following grades:

A — Excellent

This grade is given to those students whose performance in the course has been of very high graduate caliber.

B — Satisfactory

This grade is given to those students whose performance in the course has been at the level necessary for graduate credit.

C — Fair

This grade is used to indicate that the student's performance in the course may be acceptable but is not consistently at the level expected in graduate work.

F — Failure

This grade is used to indicate unsatisfactory work.

In addition, the following letter designations are used:

E — Course registration canceled for nonattendance.

I — Incomplete, without quality designation. This is used when a student does not take the final examination or otherwise fails to complete the work of the course.

S — Satisfactory, without quality designation. This is used for thesis work.

W — Withdrawn without prejudice.

An average of not less than B must be obtained in thirty course credits in order to qualify for the master's degree. If a grade of F is obtained in a required course, the course must be repeated and a grade of B or better obtained. If a grade of F is obtained in an elective course, this course may either be repeated or another elective course substituted for it. In the case of a repeated elective course, a grade of B must be obtained. A maximum of thirty-four course credits may be undertaken in qualifying for the degree.

The designation "I" will be changed to a grade upon removal of the "I" provided deficiencies are made up by the end of the semester following the one in which the "I" was reported. If the course defi-

ciencies are not made up within the specified time, the grade of I will automatically become a grade of F. Missed final examinations cannot be made up without the approval of the Dean or Director of the program involved. Approval for such make-up is given only for emergency reasons and must be obtained within one month following the date of the missed examination.

WITHDRAWALS

No withdrawal from a course is allowed after the tenth class session. Any student who is absent from three class periods in succession without excuse is dropped from the class.

The University provides all instruction and accommodations on an academic semester basis; therefore, no refunds are granted except in cases where students are compelled to withdraw because of personal illness or other reasons beyond their control. A student must complete an official withdrawal application at the Graduate School office before being considered for a refund. In no case are refunds made after a student has attended the fifth session of a class. Questions regarding refunds should be discussed with the Bursar's office.

TIME LIMITATIONS

Course credits earned in the program of graduate study are valid for a maximum period of eight years. This time limitation is likewise applicable to any offered transfer credits.

TRANSFER OF CREDITS

Not more than eight semester hours of graduate credit may be transferred from other institutions towards the degree of Master of Science or Master of Arts at Northeastern. Grades in courses offered for transfer must be B or higher. Acceptance of credits for transfer will not be approved until the student is admitted to candidacy, and then only if the work submitted for transfer credit is consonant with the objective of the approved program.

TUITION AND FEES

The policies governing the amount and the regulations pertaining to the payment of tuition and fees are established by the Executive Council of Northeastern University. The Council reserves the right to change these regulations at any time. Such changes will apply to students currently enrolled as well as new applicants for admission.

1. Schedule of Tuition and Fees

Registration Fee—payable at time of first registration	\$10.00
Matriculation Fee— for establishment of degree candidacy for students who have been in registration prior to September, 1959	10.00
Tuition — per course	60.00
Late Payment Fee—for failure to pay tuition on specified date	2.00
Make-up Final Examination Fee	5.00
Graduation Fee — payable on or before May 1 of year in which student expects to graduate	20.00

2. Payments

Tuition statements will be mailed to the students by the Student Accounts office and are payable on or before the date specified.

Checks should be drawn payable to "Northeastern University."

VETERANS

Veterans who expect to obtain educational benefits from the Veterans Administration should visit the Northeastern University Veterans office, Room 245, Richards Hall, prior to registration. The Veterans office at Northeastern University is operated by the University and is prepared to give any assistance the veteran may require in obtaining Veterans benefits.

CLASS HOURS, INSTRUCTIONAL CALENDAR

During the first and second semesters each course meets one evening per week for two hours for sixteen weeks, including the final examinations. In the summer session each course meets twice a week for a period of eight weeks. For opening and closing dates of these sessions, consult the Academic Calendar of this Bulletin.

**INTERVIEW AND REGISTRATION DATES, OFFICE HOURS,
AND CLASS SCHEDULES**

For dates of the interview and registration periods and office hours, consult the inside front cover. The registration circulars issued in August, January, and May provide information regarding class meeting times and teaching staff as well as listing the course offerings for the first semester, second semester, and summer session, respectively. Copies of these circulars may be obtained from the office of the Dean of the Graduate School, Northeastern University, Boston 15, Massachusetts, or by calling COpley 7-6600.



**Curricula
and
Course Descriptions**

The curricula of the various degree programs are given under each departmental heading. The descriptions of courses offered by the several departments are given so that prospective students may obtain a view of the course coverage. Preparation courses are indicated in each instance. Not all courses are offered every year, but the course offerings will be arranged in such a manner that students may make continuous progress toward the degree.

The number of students enrolled in each class will be limited to permit effective teaching at the graduate level and the University reserves the right to cancel any course for which an insufficient number of students apply.

One semester hour credit is awarded for the work represented by a class meeting for one hour each week for one regular sixteen-week semester. Each of the courses numbered over 100 carry two semester hours credit. Courses numbered below 100 are those offered for students who need to make up certain undergraduate deficiencies. These courses carry no graduate credit.

CHEMISTRY

TEACHING FELLOW PROGRAM

CURRICULUM—MASTER OF SCIENCE IN CHEMISTRY

Admission Requirements—An undergraduate degree with a major in Chemistry.

Departmental Requirements—Thesis credits—8

FIRST YEAR

First Semester

11.221	Adv. Org. Chem.	2
11.521	Intro. to Research	2
11.331	Thermodynamics	2
11.501	Thesis	1
		7

Second Semester

11.222	Adv. Org. Chem.	2
11.508	Seminar	1
11.332	Atom. and Molec. Struct.	2
11.502	Thesis	2
		7

SECOND YEAR

First Semester

11.111	Adv. Inorg. Chem.	2
11.237	Phys. Org. Chem.	2
11.335	Adv. Phys. Chem.	2
11.503	Thesis	2
		8

Second Semester

11.112	Adv. Inorg. Chem.	2
11.238	Phys. Org. Chem.	2
11.510	Seminar	1
11.504	Thesis	3
		8

Electives

11.244	Biochemistry	2
11.333	Chemical Kinetics	2
11.412	Optical Methods of Anal.	2
11.245	Biochemistry	2

11.240	Mechanisms of Organic Reactions	2
11.413	Electrochem. Methods of Analysis	2

EVENING PART-TIME PROGRAM

CURRICULUM—MASTER OF SCIENCE IN CHEMISTRY

Applicants for this program should have a Bachelor of Science degree with a major in Chemistry. Graduates in other science fields may be required to satisfy some undergraduate deficiencies.

Required Courses:

11.111, 112	Advanced Inorganic Chemistry	4
11.221, 222	Advanced Organic Chemistry	4
11.237	Physical Organic Chemistry	
or		
11.240	Mechanism of Organic Reactions	2
11.331	Thermodynamics	2
11.332	Atomic and Molecular Structure	2
11.333	Chemical Kinetics	
or		
11.334	Solutions of Electrolytes	2
		<hr/>
		16

Elective Courses:

Six semester hours must be selected from chemistry course offerings. Eight additional semester hours may be selected from any of the course offerings physics or mathematics provided the student has the required preparation and/or prerequisites.

DESCRIPTION OF COURSES

11.111 Advanced Inorganic Chemistry (Offered yearly, 1st sem.)

Preparation: One year of Physical Chemistry and one year of Inorganic Chemistry

Course Content: Periodic classification of the elements, characteristics based on electronic structure, complex ion formation, oxidation-reduction, chemistry of the non-metals.

11.112 Advanced Inorganic Chemistry (Offered yearly, 2nd sem.)

Preparation: 11.111 Advanced Inorganic Chemistry

Course Content: Advanced treatment of the chemistry of metals, chemical properties of the solid state, and recent developments in the field of coordination compounds and the mechanisms and stereochemistry of inorganic reactions. The significance of nuclear properties, nuclear changes, and tracer studies in inorganic chemistry is an integral part of the course.

11.221 Advanced Organic Chemistry (Offered yearly, 1st sem.)

Preparation: One and one-half years of Organic Chemistry

Course Content: An intensive coverage of the principal classes of organic compounds, their syntheses and their reactions. Chemical methods of structure determination.

11.222 Advanced Organic Chemistry (Offered yearly, 2nd sem.)

Preparation: 11.221 Advanced Organic Chemistry

Course Content: A discussion of modern valence theory which leads to the electron theory of organic chemistry. This theory is made the basis of a study of aromatic substitution, acid-base phenomena and free radicals.

11.237 Physical Organic Chemistry (Offered yearly, 1st sem.)

Preparation: 11.222 Advanced Organic Chemistry

Course Content: Correlation of structure of organic molecules and physical properties: gross physical properties, stereochemistry, dipole moments.

11.238 Physical Organic Chemistry (Offered yearly, 2nd sem.)

Preparation: 11.237 Physical Organic Chemistry

Course Content: Continuation of 11.237. Ultraviolet, infrared, and Raman Spectra, electron and X-ray diffraction, nuclear magnetic resonance, acidity and basicity.

11.240 Mechanisms of Organic Reactions (Offered yearly, 2nd sem.)

Preparation: 11.236 Advanced Organic Chemistry

Course Content: Consideration of the fundamental factors influencing the course of a chemical reaction. Study of the structural environment changes in mechanisms of organic reactions.

11.243 Natural Products (Offered yearly, 2nd sem.)

Preparation: 11.222 Advanced Organic Chemistry

Course Content: Structure determination, synthesis and transformations of selected classes of organic compounds of biological importance.

11.244 Biochemistry (Offered 1961-62, 1st sem.)

Preparation: 11.243 Natural Products and one year of Physical Chemistry

Course Content: The structure and reactions of proteins, amino acids carbohydrates, lipids. Reactions involved in biological oxidation and in metabolism.

11.245 Biochemistry (Offered 1961-62, 2nd sem.)

Preparation: 11.243 Natural Products and one of Physical Chemistry

Course Content: The structure and reactions of heterocyclic compounds, nucleic acids and enzymes. Reactions of these compounds in metabolism. Role of vitamins, hormones, and minerals in metabolism.

11.331 Thermodynamics (Offered yearly, 1st sem.)

Preparation: One year of Physical Chemistry

Course Content: First law of thermodynamics, thermochemistry second law, chemical equilibrium, solutions.

11.332 Atomic and Molecular Structure (Offered yearly, 2nd sem.)

Preparation: One year of Physical Chemistry

Course Content: Atomic spectra, atomic structure, introduction to wave mechanics, structure of matter, nature of chemical bond.

11.333 Chemical Kinetics (Offered yearly, 1st sem.)

Preparation: 11.332 Atomic and Molecular Structure

Course Content: Transition state and collision theories of chemical reactions. Reaction velocity in gaseous and liquid systems. Catalysis, chain reactions.

11.334 Solutions of Electrolytes (Offered yearly, 2nd sem.)

Preparation: One year of Physical Chemistry

Course Content: Theory of solutions of electrolytes, acids and bases, electrolytic conductance, electrochemistry.

11.340 Nuclear Chemistry (Offered 1961-62, 1st sem.)

Preparation: One year of Physical Chemistry

Course Content: Nuclear compositions, study of isotopes, natural and artificial radioactivity, nuclear reactions.

11.412 Optical Methods of Analysis (Offered 1960-61, 1st sem.)

Preparation: One year of Physical Chemistry

Course Content: Theory of emission and absorption spectroscopy, spectrophotometry, colorimetry, microscopy, and refractometry as applied to chemical analysis.

11.413 Electrochemical Methods of Analysis (Offered 1960-61, 2nd sem.)

Preparation: One year of Physical Chemistry

Course Content: Theory of potentiometry, conductivity, polarography, amperometry, coulometry, and oscillometry as applied to chemical analysis.

11.611 High-Polymer Theory and Practice (Offered yearly, 1st sem.)

Preparation: An undergraduate course in Organic Chemistry and one in Physical Chemistry

Course Content: Basic principles of polymer chemistry. Description and classification of high polymers. Addition and condensation polymerization reactions. Survey of natural and synthetic commercial polymers, including industrial methods of preparation. Introduction to the study of polymer structure and relation of structure to properties.

11.612 High-Polymer Theory and Practice (Offered yearly, 2nd sem.)

Preparation: 11.611 High-Polymer Theory and Practice

Course Content: Rheological, mechanical, thermal, optical, electrical and chemical properties of high polymers. Survey of rubbers, plastics and fibers and their various industrial applications. The major fields in which polymers are used will be discussed. Emphasis will be placed on modern practices and their relation to theoretical principles.

COURSES GIVEN IN THE DAY ONLY**11.335 Advanced Physical Chemistry** (Offered yearly, 1st sem.)

Preparation: 11.332 Advanced Physical Chemistry

Course Content: Introduction to statistical mechanics. Application to chemical kinetics, crystalline and liquid states. Light scattering of polymers.

11.501 - 11.504 THESIS (Offered yearly)

Course Content: Experimental work under department direction.

11.508 - 11.510 SEMINAR (Offered yearly)

Course Content: Reports on current fields of investigation.

11.521 Introduction to Research (Offered yearly, 1st sem.)

Preparation: Admission to graduate program

Course Content: Lectures by members of the chemistry faculty on methods and techniques of research. Brief experimental problems to introduce specialized research techniques.

ENGLISH

TEACHING FELLOW PROGRAM

CURRICULUM—MASTER OF ARTS IN ENGLISH

Admission Requirements — A bachelor's degree from an accredited institution. The undergraduate program should include fifteen semester hours of English.

Departmental Requirements — Thesis credits — 6

Reading knowledge of one foreign language

FIRST YEAR

Fall Term		Spring Term	
30.131	Grammatical Analysis ... 2	30.140	General Semantics 2
30.101	The English Novel 2	30.112	Modern British Drama .. 2
30.501	Thesis-Seminar 1	30.502	Thesis-Seminar 1
	Elective 2		Elective 2
	7		7

SECOND YEAR

Fall Term		Spring Term	
30.121	Principles of Literary Criticism 2	30.132	Introduction to Linguistics 2
30.103	Early American Fiction .. 2	30.118	Modern American Drama 2
30.503	Thesis-Seminar 2	30.504	Thesis-Seminar 2
	Elective 2		Elective 2
	8		8

DESCRIPTION OF COURSES

30.121 Principles of Literary Criticism (Offered 1960-61, 2nd sem.)

Course Content: An examination of the basic principles of literary criticism as they appear in the work of major critics of classical antiquity and of English literature from the Renaissance to the present. The lectures stress Plato, Aristotle, Longinus, Sidney, Dryden, Johnson, Coleridge, Hazlitt, Arnold, and T. S. Eliot. The readings include the work of important minor critics. Assigned papers require practical application of the principles of criticism.

30.131 Grammatical Analysis (Offered 1961-62, 1st sem.)

Course Content: A consideration of the structural elements of sentences, the substituting of functions, and the principles of analysis. Punctuation is studied as a body of structural signals. Modern language patterns are viewed in the light of their historic development.

30.132 Introduction to Linguistics (Offered 1960-61, 2nd sem.)

Course Content: The aim of the course will be to acquaint the student with the more important principles of linguistics as a science. Phonetics, phonemics, and phonology will receive considerable attention, as will also patterning, process, meaning, and others of the larger aspects of language. The approach will be descriptive and comparative. Reference and collateral work will be necessary.

30.140 General Semantics (Offered 1961-62, 2nd sem.)

Course Content: Meaning as a structural relationship involving language, thought, experience, emotion, and the world around us. The relationship of symbolism to reality and the analysis of language as communication and as a determinant of culture and civilization. Applications from several fields, including literature, art, philosophy, and science.

COURSES NOT GIVEN IN THE EVENING

30.101 The English Novel (1750-1850) (Offered 1961-62, 1st sem.)

Course Content: Background and sources of the first English novels, followed by a study of types and techniques which developed during the last half of the eighteenth century; detailed consideration of major representative novelists from Richardson to the early Victorians.

30.103 Early American Fiction (Offered 1960-61, 1st sem.)

Course Content: A study of the development of fiction in America prior to the Civil War. Emphasis will be placed on the romances of Hawthorne and Melville.

30.112 Modern British Drama (Offered 1961-62, 2nd sem.)

Course Content: A study of the major dramatists of England and Ireland during the latter part of the nineteenth and twentieth centuries, with special emphasis upon the works and theories of Shaw, Barrie, Galsworthy, Synge, O'Casey, Maugham, Coward, Eliot, and Fry.

30.118 Modern American Drama (Offered 1960-61, 2nd sem.)

Course Content: A study of the major American dramatists during the twentieth century with special emphasis upon the reflection of the thinking and the cultural pattern of America as seen in the works of O'Neill, Anderson, Sherwood, Odets, Hellman, Saroyan, Wilder, Williams, Miller.

30.501 - 4 THESIS—SEMINAR (Offered every semester)

Course Content: The thesis is written under the direction of the department.

GOVERNMENT TEACHING FELLOW PROGRAM

CURRICULUM—MASTER OF ARTS IN GOVERNMENT

Admission Requirements—A bachelor's degree from an accredited institution with the undergraduate program including at least fifteen semester hours of government.

Departmental Requirements—Thesis credits—6

Comprehensive examination

FIRST YEAR

Fall Term

22.171	U. S.-Soviet Relations . . .	2
22.131	Recent Political Theory . .	2
22.501	Thesis-Seminar	1
	Elective	2
		—
		7

Spring Term

22.180	Nationalism	2
22.200	Seminar in Public Administration	2
22.502	Thesis-Seminar	1
	Elective	2
		—
		7

SECOND YEAR

Fall Term

22.231	Seminar in U. S. Foreign Policy	2
22.151	Federal Legislative Process	2
22.503	Thesis-Seminar	2
	Elective	2
		—
		8

Spring Term

22.190	Comparative Political Parties	2
22.160	Federal Administrative Process and Public Policy .	2
22.504	Thesis-Seminar	2
	Elective	2
		—
		8

DESCRIPTION OF COURSES

22.171 United States-Soviet Relations (Offered 1961-62, 1st sem.)

Course Content: A study of the relations between the United States and the Soviet Union from 1917 to the present. Such topics as the Soviet political system, the "non-recognition" period, and the origins and nature of the present power conflict are stressed.

22.180 Nationalism (Offered 1961-62, 2nd sem.)

Course Content: An examination of the evolution and role of nationalism in contemporary international relations. Representative nationalistic movements and theories are covered.

22.190 Comparative Political Parties (Offered 1960-61, 2nd sem.)

Course Content: A comparative study of the background, organization, and function of political parties in contemporary democratic governments. The role and influence of two-party and multi-party systems in the democratic process are considered.

22.231 Seminar in United States Foreign Policy

(Offered 1960-61, 1st sem.)

Course Content: An examination of the role of the United States in world politics. Historical background, analysis of problems involved in policy formulation and execution, and specific contemporary issues are covered.

COURSES NOT GIVEN IN THE EVENING

22.131 Recent Political Theory (Offered 1961-62, 1st sem.)

Course Content: An examination of ideas from the time of the French and American revolutions to the present, with special emphasis upon the impact of economic and technical change, in the nineteenth and twentieth centuries, on the course of Western political thought.

22.151 Federal Legislative Process (Offered 1960-61, 1st sem.)

Course Content: A study of Congress and the effect on Federal legislation of the activities of the administrative and judicial branches, with particular stress on Congressional-Presidential relations.

22.160 Federal Administrative Process and Public Policy

(Offered 1960-61, 2nd sem.)

Course Content: An examination of the processes of policy execution in the Federal government with focus on the role of the President.

22.200 Seminar in Public Administration (Offered 1961-62, 2nd sem.)

Course Content: A study of selected problems in public administration at all-levels, with special attention to state and local processes.

22.501 - 504 THESIS—SEMINAR (Offered every semester)

Course Content: Thesis supervision by individual members of the department.

HISTORY TEACHING FELLOW PROGRAM

CURRICULUM—MASTER OF ARTS IN HISTORY

Admission Requirements — A bachelor's degree from an accredited institution with the undergraduate program including at least fifteen semester hours of history. If this program did not include a course in historiography or its equivalent, 23.100 Historiography must be taken.

Departmental Requirements — Thesis credits — 6

Reading knowledge of French, German or Russian

Comprehensive examination

FIRST YEAR

Fall Term		Spring Term	
23.105	Intellectual History of Europe 2	23.106	Intellectual History of Europe 2
23.109	Seminar in Modern English History 2	23.112	History of France 1870 to Present 2
23.501	Thesis 1	23.502	Thesis 1
23.100	Historiography or Elective 2		Elective 2
	7		7

SECOND YEAR

Fall Term		Spring Term	
23.115	Social and Economic History of Modern Europe 2	23.116	Social and Economic History of Modern Europe 2
23.121	Seminar in Russian History 2	23.118	Modern German History. 2
23.503	Thesis 2	23.504	Thesis 2
	Elective 2		Elective 2
	8		8

DESCRIPTION OF COURSES

23.100 Historiography (Offered yearly, 1st sem.)

Course Content: This course traces the development of historical writing from ancient times to the present. All the major historians are studied. Their styles, philosophies, methods of research and writing, as well as their accuracy in reporting, are analyzed. In addition, the varieties of source materials and the available bibliographies are examined. Students will be required to show ability in using the historical sources and constructing historical narratives by producing many written papers for this course.

23.105 Intellectual History of Europe (1600-1800)

(Offered 1961-62, 1st sem.)

Course Content: The intellectual development of seventeenth and eighteenth century Europe, as a background to more recent thought, is the subject matter of this course. Political, scientific, and philosophic thought will be emphasized, though other aspects will be considered also. Theories of absolutism and popular sovereignty, Newtonian science, and the Age of Enlightenment will be developed in full.

23.106 Intellectual History of Europe (1800-1959)

(Offered 1961-62, 2nd sem.)

Course Content: This course is a continuation of 23.105 and as such will receive basically the same emphasis. It will treat extensively the various socialist movements and their conservative counterparts; nonsocialist radical thought such as anarchism and nihilism; the growth of evolutionary theory; and the twentieth century phenomenon of totalitarianism.

23.110 American Social History to 1820 (Offered 1960-61, 1st sem.)

Course Content: The ethnological foundation of American civilization, the ways Americans made their livings, the ways in which they lived, their religion, education, arts and amusements, are the main subjects of this course.

23.111 American Social History from 1820 (Offered 1960-61, 2nd sem.)

Course Content: The central theme in this course is the effect on American life of the great growth of industry, the unprecedented rise of science and invention, and the rapid increase of population in the nineteenth and twentieth centuries.

23.115 Social and Economic History of Europe (1600-1815)

(Offered 1960-61, 1st sem.)

Course Content: This course deals with the development of the social and economic institutions of modern Europe. Beginning with the rise of capitalism and the age of exploration, it traces the expansion of colonialism and mercantilism, and their effect upon the growth of nationalism. The social and economic institutions of the great empires of Spain, France, and England, as well as the effects of the French Revolution, receive serious emphasis.

23.116 Social and Economic History of Europe (1815-1959)

(Offered 1960-61, 2nd sem.)

Course Content: This course is a continuation of 23.115. The social and economic trends that began with the Age of Enlightenment and the French Revolution are studied. The expansion of capitalism and imperialism; the rise of national states in Europe; the development of socialistic philosophies; the implications of the scientific discoveries of Charles Darwin; the origins and consequences of the two world wars; and the contemporary conflict between capitalism and communism are all emphasized.

COURSES NOT GIVEN IN THE EVENING**23.109 Seminar in Modern English History** (Offered 1961-62, 1st sem.)

Course Content: This seminar will deal with a fairly narrow span or topic in English history on a yearly basis. It will presuppose a basic knowledge of English history and will require extensive work on a term paper as well as assigned readings.

23.112 History of France (1870 to the present)

(Offered 1961-62, 2nd sem.)

Course Content: This course traces the development of the French nation from the Third Republic to the Fifth Republic. The problems growing out of the Franco-Prussian War; the causes and the results of World War I; the search for stability and justice in a period of social, political, and economic tension; the collapse of France in World War II; and the rise of a new France are all studied.

23.118 Modern German History (1870 to the present)

(Offered 1960-61, 2nd sem.)

Course Content: The importance of Germany in the late nineteenth and twentieth century will be explored in all its various facets. While the emphasis will be on internal development, Germany's relations with her neighbors and her aspirations for empire will, of necessity, receive adequate treatment.

23.121 Seminar in Russian History (Offered 1960-61, 1st sem.)

Course Content: This seminar will deal with a fairly narrow span or topic in Russian history on a yearly basis. It will presuppose a basic knowledge of Russian history and will require extensive work on a term paper as well as assigned readings.

23.501 - 504 THESIS SUPERVISION (Offered every semester)

Course Content: Written under the direction of the department.

MATHEMATICS

EVENING PART-TIME PROGRAM

CURRICULUM—MASTER OF SCIENCE IN MATHEMATICS

Applicants for this program should have a bachelor's degree in a program which contained nine semester hours beyond integral calculus, including two semesters of advanced calculus. If the mathematics which the student took went only through differential equations, or if advanced calculus was not in his program, the deficiency may be satisfied by taking 14.101 and 14.102. These will count as graduate credit electives.

Required Courses:

14.320, 321	Theory of Functions of a Complex Variable	4
14.323, 324	Theory of Functions of a Real Variable	4
14.241	Modern Algebra	2
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Elective Courses:

Ten semester hours credit must be elected from other mathematics or physics courses. The remainder may be taken from any engineering, mathematics, or physics courses for which the student has the necessary preparation.

DESCRIPTION OF COURSES

The following non-credit course is offered for those students whose undergraduate mathematical preparation is weak because they have not had differential equations or because they have been away from formal mathematical work for some time.

14.50 Introduction to Differential Equations

(Offered yearly, 1st and 2nd sem.)

Preparation: Differential and Integral Calculus

Course Content: Standard methods of solving ordinary differential equations; equations of first order and first degree; linear equations of higher order with constant co-efficients, method of undetermined co-efficients, variation of parameters; first-order equations of higher degree; special second-order equations with variable co-efficients.

GRADUATE COURSES

14.101 Advanced Mathematics (Offered yearly, 1st and 2nd sem.)

Preparation: Differential Equations

Course Content: Topics related to differential equations, including systems of equations, solution by Laplace transforms, and solution by series. Legendre and Bessel functions, Fourier series, orthogonal functions. Differentiation and integration of functions of several variables.

14.102 Advanced Mathematics (Offered yearly, 1st and 2nd sem.)

Preparation: 14.101 Advanced Mathematics

Course Content: Fundamental operations with vectors, linear vector spaces, matrices, linear transformations, orthogonal transformations, diagonalization of matrices, quadratic forms. Scalar and vector fields, gradient, line integrals, divergence and curl, divergence theorem, Stokes' theorem. Partial differential equations, wave equation, heat flow, Laplace equation, vibration of rectangular and circular membrane.

14.103 Mathematics for Chemical Engineers (Offered yearly, 1st sem.)

(Open only to co-operative chemical engineering students)

Preparation: Bachelor of Science degree in Chemical Engineering and Differential Equations

Course Content: A consolidation of mathematical procedures most used by chemical engineers. Attention is given to the problem of expressing a physical situation in mathematical language.

14.105 Advanced Mathematics (Offered yearly, 1st sem.)

(Open only to co-operative electrical engineering students)

Preparation: Differential Equations*Course Content:* Properties of series; absolute and uniform convergence; application of power series to solution of differential equations and approximation problems. Numerical analysis; solution of differential equations by Runge-Kutta method and by Taylor series, Sturm-Liouville systems and orthogonal functions; Gram-Schmidt procedure; Fourier-Bessel and Legendre series. Solution of partial differential equations of physics using above techniques.**14.106 Advanced Mathematics** (Offered yearly, 1st sem.)

(Open only to co-operative electrical engineering students)

Preparation: 14.105 Advanced Mathematics*Course Content:* Linear vector spaces, matrices, linear transformations, orthogonal transformations, diagonalization of matrices, quadratic forms. Introduction to the mathematics of probability and statistics; discrete and continuous probability distributions, including binomial, Poisson, and normal.**14.200 Numerical Analysis** (Offered yearly, 2nd sem.)*Preparation:* 14.201 Principles of Automatic Computation or knowledge of programming*Course Content:* Numerical solution of linear and non-linear systems of equations with aid of determinants, matrices. Newton's method, method of steepest descent, direct and inverse interpolation, Lagrange interpolation formula, Aitken's method, numerical differentiation and integration. Curve fitting by least squares with the use of orthogonal polynomials. Harmonic analysis. Each student will be expected to completely analyze, program and run at last one major problem on the University digital computer.**14.201 Principles of Automatic Computation** (Offered yearly, 1st sem.)*Preparation:* Differential Equations*Course Content:* Description of computing processes and programming of digital computers. Basic concepts of computation on a stored program computer as well as a detailed study of the preparation of specific programs in machine language and problem oriented languages for the IBM 650 Computer. Introduction to automatic programming including interpretation and compilation. Binary, octal, and decimal number systems. Application of general purpose digital computers to numerical problems in mathematics and physics.

14.205 Difference Equations (Offered yearly, 2nd sem.)

Preparation: 14.102 Advanced Mathematics

Course Content: Formulation and solution of difference equations; approximate solution of engineering problems by finite-difference methods; relaxation techniques; stability and convergence of approximate methods. Applications to elastic systems, electrical networks, filters, potential theory, wave propagation, heat flow, etc.

14.220 Statistics (Offered yearly, 2nd sem.)

Preparation: 14.230 Probability

Course Content: Fundamental statistical methods. Tests of significance and estimation based on large or small samples; simple correlation and linear regression; introduction to analysis of variance and sequential analysis. Application to quality control and other engineering problems.

14.230 Probability (Offered yearly, 1st sem.)

Preparation: Differential and Integral Calculus

Course Content: Permutations and combinations; addition and multiplication theorems including Bayes' theorem. Discrete and continuous probability distributions including binomial, Poisson and normal with applications.

14.241 Modern Algebra (Offered yearly, 1st sem.)

Prerequisite: 14.102 Advanced Mathematics

Course Content: Introduction to the general algebraic properties of groups, rings, ideals, fields, and algebras.

14.242 Modern Algebra (Offered yearly, 2nd sem.)

Preparation: 14.241 Modern Algebra

Course Content: Properties of general fields; Galois fields, abstract vector spaces. General linear transformations; matrices and their properties; diagonalization and inversion of matrices. Application to solution of algebraic equations, ordinary differential equations, boundary value problems, and integral equations.

14.300 Fourier Series and Boundary Value Problems

(Offered 1961-62, 2nd sem.)

Preparation: 14.102 Advanced Mathematics

Course Content: A problem course dealing with the application of trigonometric series and integrals and related forms to differential equations and boundary value problems.

14.310 Vector Analysis (Offered 1961-62, 1st sem.)

Preparation: 14.102 Advanced Mathematics

Course Content: The theory and method of vector analysis as applied in physics and applied mathematics.

14.320 Theory of Functions of a Complex Variable

(Offered yearly, 1st sem.)

Preparation: 14.102 Advanced Mathematics

Course Content: The general theory of functions of a complex variable, Cauchy's theorem, Taylor's and Laurent's series, the theory of residues, conformal mapping, the Schwartz-Christoffel transformation.

14.321 Theory of Functions of a Complex Variable

(Offered yearly, 2nd sem.)

Preparation: 14.320 Theory of Functions of a Complex Variable

Course Content: This course continues 14.320 and extends the development of the general theory of functions of a complex variable to more advanced topics. Application of the theory to physical and engineering problems.

14.323 Theory of Functions of a Real Variable (Offered yearly, 1st sem.)

Preparation: 14.242 Modern Algebra or 14.321 Theory of Functions of a Complex Variable

Course Content: Theory of sets, metric spaces and applications to the topology of the real line and Euclidean N -space, closed and open sets, continuous and uniformly continuous functions. Connected, totally bounded, and compact sets. Heine-Borel theorem, extension theorems for continuous functions and applications to integration theory.

14.324 Theory of Functions of a Real Variable (Offered yearly, 2nd sem.)

Preparation: 14.323 Theory of Functions of a Real Variable

Course Content: Integration theory on abstract measure spaces and its specialization to Lebesgue theory on the real line Outer measure, signed measure, measurable functions. Lebesgue convergence theorem, Radon-Nikodym theorem, product measures and Fubini's theorem. Vitali coverings, Lebesgue Stieltjes integral and applications to probability theory.

14.340 Calculus of Variations (Offered 1960-61, 2nd sem.)

Preparation: 14.101 Advanced Mathematics

Course Content: The minima of simple integrals in non-parametric form in three-space. Necessary and sufficient conditions for a minimum, fields, the Hamilton-Jacobi theory.

14.530 Partial Differential Equations (Offered 1960-61, 2nd sem.)

Preparation: 14.102 Advanced Mathematics

Course Content: Types of equations which are widely used in engineering. The vibrating string, Laplace's equation, the flow of heat. Fourier series and integrals, Bessel and Legendre functions, orthogonal functions.

14.540 Non-Linear Differential Equations (Offered 1960-61, 1st sem.)

Preparation: Consent of the Department

Course Content: The topological methods of Poincaré, the work of van der Pol. Oscillations, non-linear resonance, and other applications.

14.550 Integral Equations (Offered 1960-61, 1st sem.)

Preparation: Consent of the Department

Course Content: Linear integral equations, eigen-value theory, relation to infinite systems and differential equations, applications in mechanics and physics.

14.600 Differential Geometry (Offered 1961-62, 1st sem.)

Preparation: 14.102 Advanced Mathematics

Course Content: Differential properties of space curves, developable surfaces, curved surfaces, and systems of curves on surfaces.

14.700 Topology (Offered 1960-61, 2nd sem.)

Preparation: 14.102 Advanced Mathematics (may be taken concurrently)

Course Content: A survey of the fundamental problems of topology, that branch of geometry which studies those properties of geometric figures which remain invariant under bicontinuous transformations, and a discussion of its significance to most fields of modern mathematics. Detailed study of metric and general topological spaces with application to real variables, differential equations; fundamental theorem of algebra.

PHYSICS

TEACHING FELLOW PROGRAM

CURRICULUM—MASTER OF SCIENCE IN PHYSICS

Admission Requirements—A bachelor's degree from an accredited institution with an undergraduate program that included twelve semester hours of physics with modern physics and mathematics through differential equations.

Departmental Requirements—Thesis credits—6

FIRST YEAR

Fall Term			Spring Term		
15.313	Theoretical Mechanics . . .	2	15.314	Theoretical Mechanics . . .	2
15.717	Statistical Mechanics and Thermodynamics	2	15.214	Introduction to Quantum Mechanics	2
15.503	Electromagnetic Theory .	2	15.504	Electromagnetic Theory .	2
15.905	Thesis	1	15.906	Thesis	1
		7			7

SECOND YEAR

Fall Term			Spring Term		
15.111	Mathematical Physics . . .	2	15.216	Advanced Quantum Mechanics	2
15.215	Quantum Mechanics	2	15.222	Advanced Nuclear Physics	2
15.255	Atomic and Nuclear Physics	2	15.901	Current Problems in Research	2
15.907	Thesis	2	15.908	Thesis	2
		8			8

EVENING PART-TIME PROGRAM

CURRICULUM—MASTER OF SCIENCE IN PHYSICS

Applicants for this program should have a bachelor's degree from an accredited institution. The undergraduate program should include mathematics through differential equations and twelve semester hours of physics, including modern physics. If the mathematics background is lacking in differential equations, 14.50 may be taken to satisfy this requirement.

Required Courses:

14.101, 102	Advanced Calculus	4
15.211, 212	Introduction to Quantum Theory	4
15.111, 112	Mathematical Physics	4
15.220	Introduction to Nuclear Physics	2
15.901	Current Research Problems in Physics	2
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		16

Elective Courses:

Eight semester hours must be selected from other physics courses. Six semester hours may be selected from any engineering, mathematics, or physics courses for which the student has the necessary preparation.

DESCRIPTION OF COURSES

COURSES OPEN ONLY TO ENGINEERING AND MATHEMATICS MAJORS

15.101 Theoretical Physics (Offered yearly, 1st and 2nd sem.)

Preparation: 14.102 Advanced Mathematics

Course Content: The basic methods and fundamental theories forming the classical foundation of physics. A mathematical formulation of these concepts illustrates in application the standard fields of physics such as mechanics and electromagnetic fields.

15.102 Theoretical Physics (Offered yearly, 1st and 2nd sem.)

Preparation: 15.101 Theoretical Physics

Course Content: This course continues the work of 15.101 with application of the basic concepts of physics to the fields not covered in the first semester, such as thermodynamics, statistical mechanics, hydrodynamics, and if time permits, the extension of these concepts to the more recent fields.

15.105 Advanced Physics (Offered yearly, 2nd sem.)

(Open only to co-operative electrical engineering students)

Preparation: 14.106 Advanced Mathematics

Course Content: Selected topics of theoretical physics of special interest to electrical engineers. Emphasis is placed on electrostatics and wave propagation.

15.201 Modern Physics (Offered yearly, 1st sem.)

Preparation: 15.101 Theoretical Physics

Course Content: A study of the physical discoveries made since 1900. Introduction to special relativity. The discovery of the electron; its emission from matter. The origins of quantum theory with Planck and Einstein. The nuclear atom and the Bohr theory of hydrogen and its spectrum. Schrodinger's wave mechanics. Atomic structure and optical spectra.

15.202 Modern Physics (Offered yearly, 2nd sem.)

Preparation: 15.201 Modern Physics

Course Content: A continuation of the first semester. X rays. Wave mechanics of bulk matter: specific heats, ideal gases, crystalline solids. The atomic nucleus: natural radioactivity, isotopes, artificial radioactivity, the neutron, the proton, the positron, particle accelerators, nuclear reactions, nuclear forces, fission and fusion. Cosmic rays and fundamental particles.

15.225 Semiconductor Physics (Offered yearly, 1st sem.)

Preparation: Differential Equations

Course Content: A study of the mechanisms of conduction in solids, excess electrons and holes as current carriers, n-type and p-type semiconductors, p-n junctions, rectifiers and transistors. Comparison of metals, insulators, and semiconductors from an introductory quantum viewpoint. Considerations of surface states, crystal growth, and the effect of imperfections in crystals.

15.226 Semiconductor Physics (Offered yearly, 2nd sem.)

Preparation: 15.225 Semiconductor Physics or its equivalent

Course Content: Studies of electrical and physical properties of semiconductors, thermoelectricity, resistivity, mobility, and lifetimes of current carriers. Hall Effect, conversion of solar energy, photoelectric effects, surface effects. Scattering, diffusion, structure of p-n junctions, transistor and rectifier theory. Basic theories of wave mechanics, statistical mechanics, and band structure applied to semiconductors.

COURSES OPEN TO STUDENTS WITH THE NECESSARY PREPARATION

15.111 Mathematical Physics (Offered yearly, 1st and 2nd sem.)

Preparation: Admission to Mathematics or Physics Graduate Program

Course Content: The formulation and solution of the partial differential equations of physics. Special emphasis is given to orthonormal functions and their use in the solution of partial differential equations.

15.112 Mathematical Physics (Offered yearly, 2nd sem.)

Preparation: 15.111 Mathematical Physics

Course Content: This course continues the work of 15.111 and applies and extends the methods developed. An introduction to group theory and its use in the solution of physical problems.

15.123 Introduction to the Theory of Relativity

(Offered 1960-61, 2nd sem.)

Preparation: 14.102 Advanced Mathematics

Course Content: Tensor analysis, transformation of coordinate systems. Inertial frames. Failure of Galilean transformations in electromagnetic theory. Lorentz transformations and Relativistic Mechanics. Applications. Principle of equivalence and introduction to the general theory.

15.211 Introduction to Quantum Theory (Offered yearly, 1st sem.)

Preparation: 14.102 Advanced Mathematics

Course Content: Postulational formulation of quantum mechanics. The basic theory in both operator and matrix formulation. An introduction to the philosophy and structure of quantum theory. Application to atomic spectra.

15.212 Introduction to Quantum Theory (Offered yearly, 2nd sem.)

Preparation: 15.211 Introduction to Quantum Theory

Course Content: This course continues the work of 15.211. Time independent and time dependent perturbation theory. The use of group theory and application to physical problems.

15.213 Advanced Quantum Mechanics (Offered 1960-61, 1st sem.)

Preparation: 15.212 Introduction to Quantum Theory

Course Content: Elements of quantum theory of radiation. Elements of field theory. Finemon diagrams and elementary particles.

15.220 Introduction to Nuclear Physics (Offered yearly, 1st sem.)

Preparation: 15.212 Introduction to Quantum Theory

Course Content: Radioactivity, alpha, beta, and gamma ray spectra. Nuclear structure and nuclear forces. Interaction of charged particles, neutrons, and photons with matter. Detection and measurement of charged particles, neutrons and photons. Nuclear reactions.

15.222 Advanced Nuclear Physics (Offered yearly, 2nd sem.)

Preparation: 15.220 Introduction to Nuclear Physics (or equivalent)

Course Content: General properties of nuclei and theories of nuclear structure and composition. Nuclear forces and statistics. The general and formal theory of nuclear reactions.

15.231 Solid State Physics (Offered yearly, 1st sem.)

Preparation: 15.212 Introduction to Quantum Theory

Course Content: This course reviews certain aspects of thermodynamics, statistical mechanics and quantum theory for application to the theory of the solid state and develops the classical and modern theories of the solid state.

15.232 Solid State Physics (Offered yearly, 2nd sem.)

Preparation: 15.231 Solid State Physics

Course Content: This course continues the work of 15.231. A study of the optical properties of crystals and metals. Statistical mechanics of electrons. Fermilevels, Brillouin zones and modern theories of conduction. Application to semiconductors and transistors.

15.250 Plasma Physics (Offered 1960-61, 1st sem.)

Prerequisites: 15.102 Theoretical Physics or 15.504 Electromagnetic Theory

Course Content: Motion of charged particles in fields. Boltzmann theory applied to plasmas. Treatment of waves in plasmas. Charged particle interactions. Derivation of the equations of hydrodynamics. Plasma oscillations and an introduction to the theory of magnetohydrodynamics.

15.252 Upper Atmospheric Physics (Offered 1960-61, 2nd sem.)

Prerequisites: 15.250 Plasma Physics

Course Content: Mathematical formulation of idealized equilibrium atmospheres. Geoelectric and geomagnetic fields. Physics of the ionosphere. Solar and cosmic radiation. Meteor physics. Theoretical and experimental examinations of current space technology problems.

15.315 Theoretical Mechanics (Not open to Civil and Mechanical Engineering majors) (Offered 1961-62, 1st sem.)

Preparation: 14.102 Advanced Mathematics

Course Content: A study of the fundamental laws of statics and dynamics. The equilibrium state and an introduction to the calculus of variations. Formulation of mechanics according to Newton, Lagrange and Hamilton. Applications.

15.316 Theoretical Mechanics (Offered 1961-62, 2nd sem.)

Preparation: 15.315 Theoretical Mechanics

Course Content: This course continues the work of 15.315 and develops the transformation theory of mechanics. Application to particles and rigid bodies.

15.503 Electromagnetic Theory (Offered yearly, 1st sem.)

Preparation: 14.102 Advanced Mathematics

Course Content: The classical theory of the electromagnetic field as described by Maxwell's Equations. The problems of electro and magneto statics.

15.504 Electromagnetic Theory (Offered yearly, 2nd sem.)

Preparation: 15.503 Electromagnetic Theory

Course Content: This course continues the work of 15.503. Time dependent fields. The basic problems in radiation propagation and diffraction of electromagnetic waves.

15.901 Current Research Problems in Physics (Offered yearly, 2nd sem.)

Preparation: Consent of the department

Course Content: Papers reviewing some of the more important fields of interest in physics.

COURSES GIVEN IN THE DAY ONLY**15.105 Advanced Physics** (Offered yearly, 2nd sem.)

(Open only to co-operative electrical engineering students)

Preparation: 14.106 Advanced Mathematics

Course Content: Selected topics of theoretical physics of special interest to electrical engineers. Emphasis is placed on electrostatics and wave propagation.

15.214 Introduction to Quantum Mechanics (Offered yearly, 2nd sem.)

Preparation: Admission to Teaching Fellow Program

Course Content: Failure of classical mechanics to account for atomic phenomena; development of old quantum theory. Indetermination principle, correspondence principle and their consequences. Schrodinger equation and solution of simple problems.

15.215 Quantum Mechanics (Offered yearly, 1st sem.)

Preparation: 15.214 Introduction to Quantum Mechanics

Course Content: Solution of three dimensional problems by use of Schrodinger equation. Hilbert space, operation and matrices. Time independent and time dependent perturbation theory.

15.216 Advanced Quantum Mechanics (Offered yearly, 2nd sem.)

Preparation: 15.215 Quantum Mechanics

Course Content: Elements of quantum theory of radiation and of field theory. Feinmann diagrams. Elementary particles.

15.255 Atomic and Nuclear Physics (Offered yearly, 1st sem.)

Preparation: 15.504 Electromagnetic Theory

Course Content: Relativistic dynamics and review of atomic physics. Static properties of nuclei. Radioactivity. Nuclear reactions.

15.313 Theoretical Mechanics (Offered yearly, 1st sem.)

Preparation: Admission to the Teaching Fellow Program

Course Content: A study of the fundamental laws of statics and dynamics. The equilibrium state and an introduction to the calculus of variations. Formulation of mechanics according to Newton, Lagrange and Hamilton Applications.

15.314 Theoretical Mechanics (Offered yearly, 2nd sem.)

Course Content: This course continues the work of the first semester and develops the transformation theory of mechanics. Application to particle and rigid bodies.

15.717 Statistical Mechanics and Thermodynamics

(Offered yearly, 1st sem.)

Course Content: A discussion and development of laws of classical mechanics when the initial state of the system under consideration cannot be specified with the accuracy that would be theoretically required. Development of the thermodynamic laws from this point of view. Discussion of Maxwell Boltzman, Fermi-Dirac, Einstein-Bose statistics.

15.905 - 15.908 THESIS (Offered yearly)

Experimental or theoretical work under the direction of the department.

PSYCHOLOGY TEACHING FELLOW PROGRAM

CURRICULUM—MASTER OF ARTS IN PSYCHOLOGY

Admission Requirements—A bachelor's degree from an accredited institution with a major in Psychology. Students with fifteen semester hours of psychology will be considered.

Departmental Requirements—Thesis credits—6

Reading knowledge of French or German

FIRST YEAR

Fall Term		Spring Term	
25.101	Statistics in Psychology . . . 2	25.104	The Nature of Motivation 2
25.111	Advanced Experimental Psychology 2	25.112	Advanced Experimental Psychology 2
25.151	Thesis 1	25.152	Thesis 1
	Elective 2		Elective 2
	7		7

SECOND YEAR

Fall Term		Spring Term	
25.121	Tests and Test Procedures 2	25.108	Personality Theory 2
25.105	Learning 2	25.130	History of Psychology . . . 2
25.153	Thesis 2	25.154	Thesis 2
	Elective 2		Elective 2
	8		8

DESCRIPTION OF COURSES

25.101 Statistics in Psychology (Offered 1960-61, 1st sem.)

Preparation: A basic course in Statistics through simple analysis of variance

Course Content: This course is concerned with some of the more complex quantitative methods available for the analysis of psychological data. Such topics as tests of significance, multiple and partial correlation, complex analysis of variance, covariance, sampling techniques, and nonparametric methods will be considered.

25.104 The Nature of Motivation (Offered 1960-61, 2nd sem.)

Course Content: This course is concerned with the nature and determinants of motivation, the instigators of thought and action. Dealing with both animal and human motives, but centering mainly upon the latter, the basic theories as well as relevant experimental evidence and methodological problems will be considered. Members of the class will participate in the presentation of material.

25.108 Personality Theory (Offered 1961-62, 2nd sem.)

Course Content: This course is concerned with a study of the various theories which have made important contributions to an understanding of the human personality. Emphasis will be placed upon those theories which have evolved since 1900, but some attention will be given to prior contributory influences. Readings from original sources will supplement class work.

25.121 Tests and Test Procedures (Offered 1961-62, 1st sem.)

Preparation: A basic course in Statistics

Course Content: This course offers a survey of the various kinds of psychological tests currently available. A number of representative, widely used tests will be considered intensively. Principles of test construction will be dealt with, accompanied by practice in the construction of a "new" test. Specific topics include assessment of validity and reliability, establishment of norms, and item analysis.

COURSES NOT GIVEN IN THE EVENING

25.105 Learning (Offered 1961-62, 1st sem.)

Course Content: The course is concerned with the factors involved in human and animal learning. Various theoretical approaches will be discussed, and a major emphasis will be placed upon relevant experimental findings. Such topics as conditioning, problem solving, transfer, acquisition of skills, and retention will be considered.

5.111 Advanced Experimental Psychology (Offered 1960-61, 1st sem.)

Course Content: Students will carry out and report on experiments in a variety of areas of behavior. Such areas as psychophysics (vision and audition), preception, cognitive processes, and learning will be treated.

5.112 Advanced Experimental Psychology (Offered 1960-61, 2nd sem.)

Prerequisite: 25.111 Advanced Experimental Psychology

Course Content: Students will design, carry out and report on several original experiments in areas of their choosing. Problems of experimental design and methodology will be considered.

5.130 The History of Psychology (Offered 1961-62, 2nd sem.)

Course Content: This course attempts to evaluate modern psychology in the light of its historical origins. The historical background provided by philosophy, as well as by the physical, social, and medical sciences, will be considered in detail. Members of the class will participate in the presentation of the material.

5.151 - 25.154 THESIS (Offered yearly)

Experimental work under the direction of the department.





GIFTS AND BEQUESTS

Northeastern University will welcome gifts and bequests for the following purposes:

- (a) For its building program.
- (b) For general endowment.
- (c) For specific purposes which may especially appeal to the donor.

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NORTHEASTERN UNIVERSITY
GRADUATE SCHOOL

PROGRAMS IN
EDUCATION

CATALOGUE 1960-1961



BOSTON 15, MASSACHUSETTS

APRIL 1960

Interview Periods and Regular Sessions

1960 SUMMER SESSION

Interview Period	June 20-June 25
Registration Period	June 20-June 25
Regular Session	June 27-Aug. 5

1960-1961 FIRST SEMESTER

Interview Period	Sept. 12-Sept. 17
Registration Period	Sept. 12-Sept. 17
Regular Session	Sept. 19-Jan. 28

1960-1961 SECOND SEMESTER

Interview Period	Jan. 30-Feb. 4
Registration Period	Jan. 30-Feb. 4
Regular Session	Feb. 6-June 3

1961 SUMMER SESSION

Interview Period	June 19-June 24
Registration Period	June 19-June 24
Regular Session	June 26-Aug. 5

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Monday Through Friday	8:45 a.m.- 5:00 p.m.
Saturday	8:45 a.m.-12:00 noon

SPECIAL OFFICE HOURS DURING REGISTRATION PERIODS ONLY

Monday Through Friday	8:45 a.m.- 8:00 p.m.
Saturday	9:00 a.m.-12:00 noon

The office is closed on all legal holidays.

Requests for Bulletins and information about graduate work in the Education Division should be addressed to

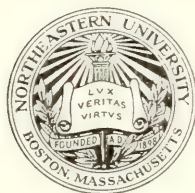
DIRECTOR, EDUCATION PROGRAMS THE GRADUATE SCHOOL

Northeastern University
360 Huntington Avenue, Boston 15, Massachusetts
COpley 7-6600

NORTHEASTERN UNIVERSITY
GRADUATE SCHOOL

PROGRAMS IN
EDUCATION

CATALOGUE 1960-1961



LEADING TO THE DEGREE OF MASTER OF EDUCATION

BOSTON 15, MASSACHUSETTS

APRIL 1960

GRADUATE PROGRAMS

AT

NORTHEASTERN UNIVERSITY

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Teaching Fellow Programs in Accounting leading to the Master of Business Administration degree.

Evening Programs leading to the Master of Business Administration degree.

EDUCATION

Late Afternoon, Evening, and Saturday Morning Programs leading to the Master of Education degree.

ENGINEERING

Co-operative Programs leading to the Master of Science degree in Chemical Engineering, in Civil Engineering with a major in Structures, in Mechanical Engineering with a major in Mechanics, and in Electrical Engineering.

Evening Programs leading to a Master of Science degree in Civil Engineering, Electrical Engineering, Communications, Engineering Management, Engineering Mechanics, and Mechanical Engineering.

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ACADEMIC CALENDAR

MAY 1960 - JUNE 1961

SUMMER SESSION 1960

Interview and Registration Period	Monday-Saturday	June 20-June 25
Classes Begin	Monday	June 27
Independence Day, No Classes	Monday	July 4
Classes End	Friday	July 29
Examination Period	Monday-Friday	Aug. 1-Aug. 5

FIRST SEMESTER 1960-1961

Interview and Registration Period	Monday-Saturday	Sept. 12-Sept. 17
Classes Begin	Monday	Sept. 19
Columbus Day, No Classes	Wednesday	Oct. 12
Veterans' Day, No Classes	Friday	Nov. 11
Thanksgiving Vacation	One Week	Nov. 21-Nov. 27
Classes Resume	Monday	Nov. 28
Christmas Vacation	Two Weeks	Dec. 20-Jan. 3
Classes Resume	Tuesday	Jan. 3
Classes End	Saturday	Jan. 21
Examination Period	Monday-Saturday	Jan. 23-Jan. 28
No Classes	Monday-Saturday	Jan. 30-Feb. 4

SECOND SEMESTER 1960-1961

Interview and Registration Period	Monday-Saturday	Jan. 30-Feb. 4
Classes Begin	Monday	Feb. 6
Washington's Birthday, No Classes	Wednesday	Feb. 22
Spring Vacation	One Week	April 17-April 23
Classes Resume	Monday	April 24
Classes End	Saturday	May 27
Memorial Day, No Classes	Tuesday	May 30
Examination Period	Monday-Saturday	May 29-June 3

CALENDAR

APRIL 1, 1960 - JUNE 30, 1961

1960

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1961

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APRIL

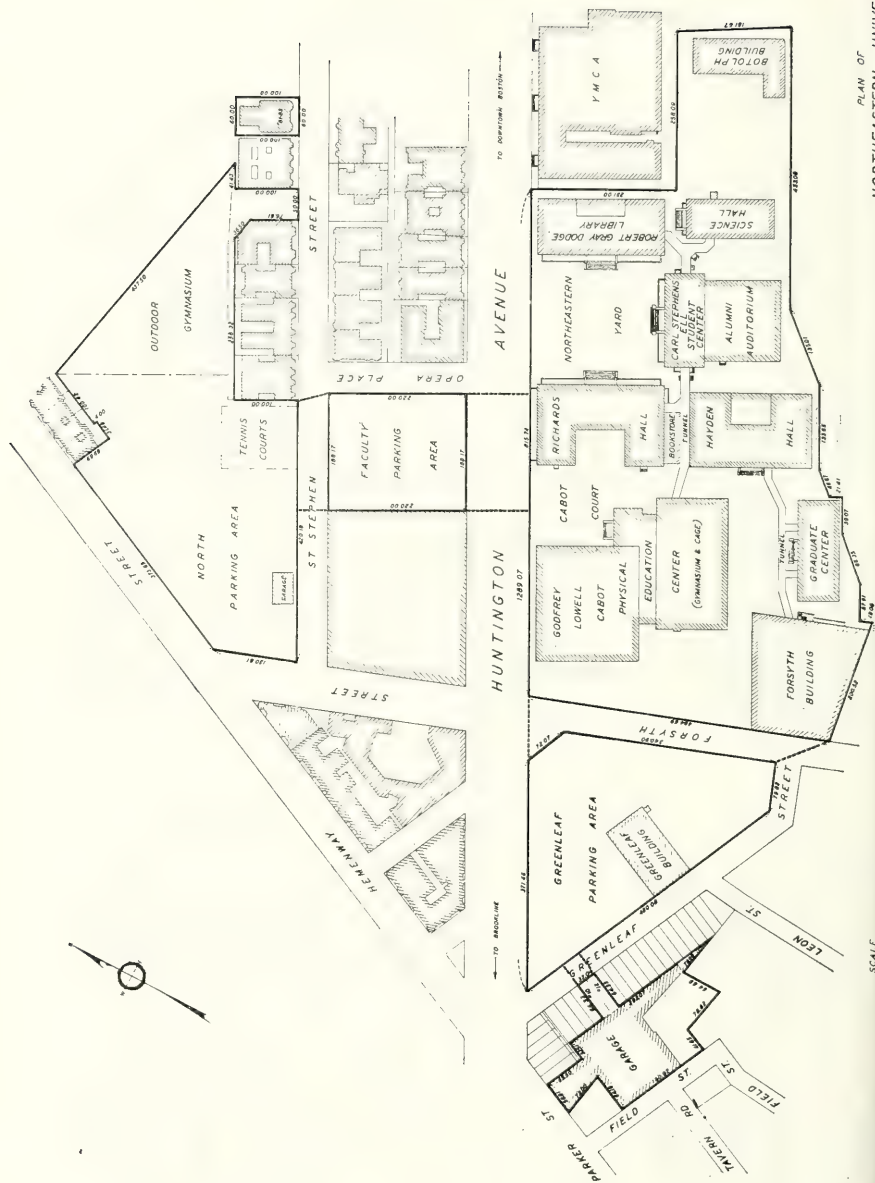
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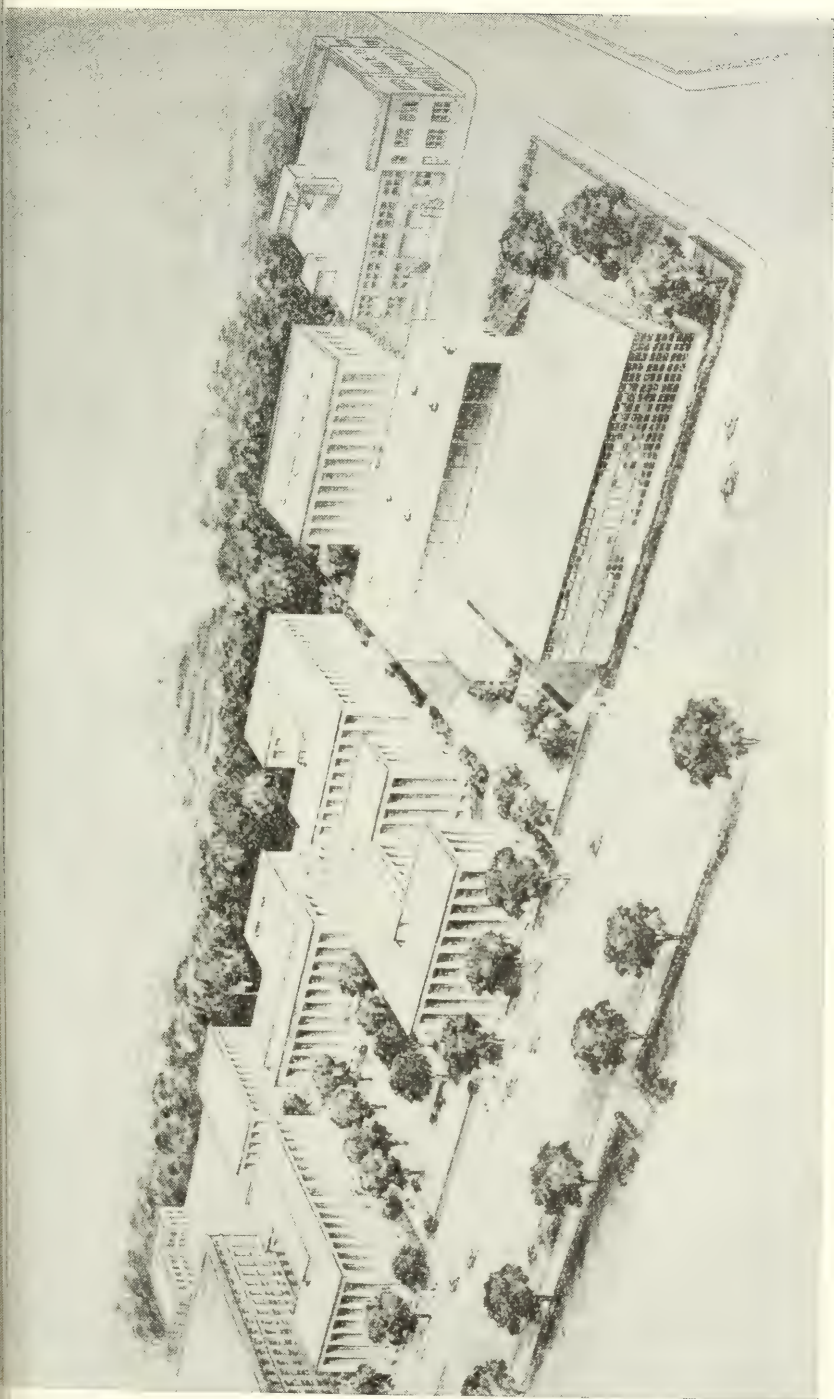
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RUDOLPH M. MORRIS, S.B., Ed.M.

Registrar of the College

MYRON J. SPENCER, A.B., M.A.

Director of Graduate Study in Business

ROLAND H. MOODY, A.B., B.L.S.

Director of University Libraries

HERBERT W. GALLAGHER, S.B.

Director of Student Activities

PHILIP W. PENDLETON, B.A., M.A., Ph.D.

Director of Testing and Counseling Center

RUDOLF O. OBERG, S.B., Ed.M.

Director of Alumni Relations

GEORGE A. SPEERS, A.B., M.S., Ed.M.

Director of Press Bureau

DESCOMB T. STEWART, A.B.

Editor and Director of Office of University Publications

J. KENNETH STEVENSON, B.C.S.

Superintendent of Buildings and Grounds

WILLIAM M. STEWART, B.S.

Manager of the Bookstore

RICHARD E. SPRAGUE, S.B., B.B.A., M.B.A., Ed.M.

Secretary of the Faculty

DANIEL J. ROBERTS, JR., S.B., M.B.A., Ed.M.

Bursar

THE GRADUATE SCHOOL

- ARTHUR ANDREW VERNON, S.B., M.S., Ph.D. *Dean of the Graduate School*
 EMIL ANTON GRAMSTORFF, S.B., M.S. *Dean of Graduate Study in Engineering*
 GEORGE WILLIAM HANKINSON, A.B., S.B., M.S.
Assistant Dean of Graduate Study in Engineering
 TYRON JAY SPENCER, A.B., M.A.
Director of Graduate Study in Business Administration
 ELLIOTT SETH VANDER WERF, A.B., M.A., Ed.D.
Dean of College of Education, Director of Graduate Study in Education
 ELLIOTT WALKER, A.B. *Registrar of the Graduate School*
 CHARLES MICHAEL DEVLIN, B.S. *Administrative Assistant*

University Advisory Committee on Graduate School Policy

- ARTHUR ANDREW VERNON, S.B., M.S., Ph.D., *Chairman*
Dean of the Graduate School
 ELLIOTT WALKER, A.B., *Secretary*
Registrar of the Graduate School
 ELMER HENRY CUTTS, A.B., M.A., Ph.D.
Professor of History and Chairman of the Department
 LAWRENCE DURHAM, A.B., M.A. *Associate Professor of Social Science*
 MARTIN WHITE ESSIGMANN, S.B., M.S.
Professor of Electrical Engineering and Chairman of the Department
 ALFRED JOHN FERRETTI, B.S., M.S.
Professor of Mechanical Engineering and Chairman of the Department
 EMIL ANTON GRAMSTORFF, S.B., M.S.
Dean of Graduate Study in Engineering and Professor of Civil Engineering
 GEORGE WILLIAM HANKINSON, A.B., S.B., M.S.
*Assistant Dean of Graduate Study in Engineering,
 and Associate Professor of Civil Engineering*
 MORRIS A. HOROWITZ, B.A., Ph.D.
Professor of Economics and Chairman of the Department
 ARTHUR KEV KIBARLAN, B.S., M.B.A., Ph.D.
Assistant Professor of Marketing and Advertising
 GIOVANNI LANZA, Ph.D. *Associate Professor of Physics*
 ROBERT ANDREWS SHEPARD, B.S., Ph.D.
Professor of Chemistry and Chairman of the Department
 TYRON JAY SPENCER, A.B., M.A.
*Director of Graduate Study in Business Administration
 and Professor of Economics*
 ALPH ANDERSON TROUPE, B.S., M.S., Ph.D.
Research Professor of Chemical Engineering

LESTER SETH VANDER WERF, A.B., M.A., Ed.D.

Dean of College of Education and Director of Graduate Study in Education

WILLIAM CROMBIE WHITE, S.B., Ed.M., Eng.D.

Vice-President and Provost of the University

EDWARD RICE WILLETT, B.S., M.A., Ph.D.

Professor of Finance and Chairman of the Department

ASA SMALLIDGE KNOWLES, A.B., A.M., LL.D. (*ex officio*)

President of the University

Committee on Graduate Study in Education

LESTER SETH VANDER WERF, A.B., M.A., Ed.D., *Chairman*

Dean of College of Education, Director of Graduate Education Program

THOMAS JAMES CAVANAGH, A.B., Ed.M.

Asst. Dean of College of Education

EUGENE LAWRENCE DURHAM, A.B., M.A.

Associate Professor of Social Science

CHARLES FRANCIS HALEY, B.S., Ed.M.

Assistant Professor of Education

FRANK E. MARSH, A.B., Ed.M.

Assistant Professor of Education

ARTHUR ANDREW VERNON, S.B., M.S., Ph.D.

Dean of the Graduate School and Professor of Chemistry

WILLIAM CROMBIE WHITE, S.B., Ed.M., Eng.D.

Vice President and Provost of the University

ROBERT GREGG WILFONG, A.B., M.A.

Associate Professor of Government and Chairman of the Department

TEACHING STAFF

The teaching staff of the Graduate Education Programs is composed of regular full-time faculty members of Northeastern University and members of the faculties of neighboring institutions. The composition of the teaching staff during any particular school year is dependent upon the courses offered during that year. The teaching staff of the Graduate Education Programs includes the following:

ROBERT L. BERK	<i>Educational Psychologist, Winthrop Foundation. Massachusetts Eye and Ear Infirmary</i>
THOMAS J. CAVANAGH	<i>Asst. Dean of College of Education, Northeastern University</i>
DAVID COOK	<i>Asst. Prof. of Education and Counselor in Testing & Counseling Center, Northeastern University</i>
JOSE F. DANIELSON	<i>Asst. Prof. of Education, Northeastern University</i>
EUGENE LAWRENCE DURHAM	<i>Assoc. Prof. of Social Science, Northeastern University</i>
EUGENE FERGUSON	<i>Teacher, Newton High School</i>
HARLES FRANCIS HALEY	<i>Asst. Prof. of Education and Director of Student Teaching, Northeastern University</i>
ARDNER W. HANDY	<i>Instructor in Arithmetic, Administrative Assistant, and Teacher-Counselor, Winchester Junior High School</i>
RICHARD HUBBARD	<i>Lecturer in Mathematics, Northeastern University</i>
BERT W. KOCH	<i>Audiologist and Speech Pathologist, Winthrop Foundation, Massachusetts Eye and Ear Infirmary</i>
MARY J. LEE	<i>Instructor in Education, Northeastern University</i>
WILLIAM B. MACPHERSON	<i>Teacher, Somerville Public Schools</i>

REUBEN J. MARGOLIN	<i>Counseling Psychologist, Director Member-Employee Program, U. S. V. A. Hospital, Brockton</i>
FRANK E. MARSH	<i>Asst. Prof. of Education, Northeastern University</i>
ALBERT E. NAVEZ	<i>Head of Science Department, Newton High School & Jr. College</i>
MARGARET M. OTTO	<i>Special Education Counselor, Newton Public Schools</i>
ALICE L. PALUBINSKAS	<i>Asst. Prof. of Psychology, Tufts University</i>
GUY A. PETRALIA	<i>Vice-Principal, Arlington High School</i>
WILLIAM A. PHILBRICK, JR.	<i>State Supervisor of Speech Handicapped, Hard of Hearing, and Deaf, Department of Education, Commonwealth of Massachusetts</i>
GUSTAV S. ROOK	<i>Prof. of Graphic Science, Northeastern University</i>
GERSHEN ROSENBLUM	<i>Chief Psychologist, Boston Floating Hospital</i>
KATHERINE TORRANT	<i>Consultant in Reading, Newton Public Schools</i>
DONALD K. TUCKER	<i>Asst. Prof. of Education, Northeastern University</i>
E. DAVIS WOODBURY	<i>Superintendent of Schools, Milton</i>
HAROLD S. ZAMANSKY	<i>Asst. Prof. of Psychology, Northeastern University</i>

NORTHEASTERN UNIVERSITY

GENERAL INFORMATION

Northeastern University is incorporated as a philanthropic institution under the General Laws of Massachusetts. The State Legislature, by special enactment, has given the University general degree granting powers.

The Corporation of Northeastern University consists of men who occupy responsible positions in business and the professions. This Corporation elects from its membership a Board of Trustees in whom the control of the institution is vested. The Board of Trustees has four standing committees: (a) an Executive Committee which has general supervision of the financial and educational policies of the University; (b) a Committee on Buildings which has general supervision over the building needs of the University; (c) a Committee on Funds and Investments which has the responsibility of administering the funds of the University; (d) a Committee on Development which is concerned with furthering the development plans of the University.

Founded in 1898, Northeastern University, from its beginning, has had as its dominant purpose the discovery of human and social needs and the meeting of these needs in distinctive and highly serviceable ways. While subscribing to the most progressive educational thought and practice, the University has not duplicated the programs of other institutions but has sought "to bring education more directly into the service of human needs."

UNDERGRADUATE PROGRAMS

The College of Liberal Arts offers majors in the usual fields of the arts and sciences leading to the degrees of Bachelor of Arts and Bachelor of Science. With the exception of pre-professional programs, day curricula are normally five years in length and operated on the Co-operative Plan. However, in all majors except Chemistry and Physics, qualified students, with the approval of the Dean, may elect to complete the requirements for the degree on a full-time plan in four years.

The College of Liberal Arts offers certain of its courses during evening hours, constituting a program of three years' duration equivalent in hours to one-half the requirements for the A.B. or S.B. degree. The degree of Associate in Arts is conferred upon those who complete this program. A complete A.B. program is also offered in the evening division with curricula in Economics, History and Government, and Sociology.

The College of Education offers the option of study on the conventional four-year full-time plan or on the five-year Co-operative Plan. Both programs lead to the degree of Bachelor of Science in Education. These are designed particularly to meet the needs of high school graduates who desire to prepare themselves for teaching and administrative positions in elementary and secondary schools.

The College of Business Administration offers five-year co-operative curricula in Accounting, Business Management, Finance and Insurance, Industrial Relations, and Marketing and Advertising leading to the degree of Bachelor of Science in Business Administration.

The School of Business — operated during evening hours — offers undergraduate curricula leading to the degree of Bachelor of Business Administration in Accounting, Management, Law and Business, Engineering and Management, Liberal Arts and Business. For students who because of occupational reasons desire shorter programs concentrating in specific areas, Institutes awarding the certificate are offered in various fields.

The College of Engineering offers five-year co-operative curricula in Civil, Mechanical, Electrical, Chemical, and Industrial Engineering leading to the degree of Bachelor of Science with specification according to the department in which the student qualifies.

GRADUATE PROGRAMS

Graduate work was started for teaching fellows in 1940 and has since expanded into six departments.

In response to a need for evening work on the graduate level, course work in certain engineering areas was started in 1948. This program

developed rapidly, and at present evening programs leading to the Master of Science degree are given in seven engineering and science departments. A co-operative graduate program in engineering was started in 1956, and at present degrees from this plan of study are offered by four engineering departments.

The evening graduate work was expanded in 1951 by a program leading to the Master of Business Administration degree; in 1953 a similar program was initiated to allow students to earn a Master of Education degree in late-afternoon or evening classes.

The teaching fellow programs enable graduate students to further their academic training while they obtain valuable experience in teaching. The evening programs are designed for those who wish to carry on advanced study on a part-time basis while continuing their regular employment. In the co-operative programs students alternate work periods with study periods so that industrial experience can be obtained along with advanced academic training. The courses in all programs have been designed to give penetrating understanding of fundamentals as well as a breadth of knowledge in allied fields.

BUILDINGS AND FACILITIES

LOCATION

Northeastern University is located on Huntington Avenue in the Back Bay section of Boston. The main administrative offices of the University are located in Richards Hall.

The chief railroad centers of Boston are the North and South Stations. To reach the University from the North Station, board an MTA subway car going to Park Street and transfer there to any Huntington Avenue car. To reach the University from the South Station, board a Cambridge-bound subway train and transfer at Park Street to a Huntington Avenue car. The "Northeastern" station is the first stop outside the subway.

HUNTINGTON AVENUE CAMPUS

The principal educational buildings of Northeastern University are located on a sixteen-acre site in the Back Bay section of Boston. Only one block to the west of the University lie the famous Boston Museum of Fine Arts and the beautiful public gardens-park reservation known as "The Fenway."

Following a long-range development plan, University facilities have expanded substantially in recent years. In addition to the six buildings constructed within the last two decades, several modernized older buildings are available for specialized uses. The newer buildings on the campus are interconnected by means of tunnels, so that the students may go from building to building without going out of doors in inclement weather. All of the buildings are used in common by the students of the four colleges.

In addition to classrooms and instructional offices, the principal buildings include the following:

Botolph Building — Civil Engineering Laboratories

Cabot Physical Education Center — Gymnasium, Cage, Rifle Range

Dodge Library — Library, Drawing Rooms

Ell Student Center — Student Activities, Health Department, Chapel Auditorium, and University Commons

Forsyth Building — Industrial and Mechanical Engineering Laboratories

Graduate Center — Administrative Offices of the Graduate School
Physics Laboratories, and Cafeteria.

Greenleaf Building — ROTC Headquarters, Research Facilities

Hayden Hall — Offices of the University College, Business, Education and Electrical Engineering Laboratories, Art Studio

Richards Hall — Administrative Offices, Mechanical Engineering, Psychology and Chemistry Laboratories, Bookstore

Science Hall — Chemical Engineering and Biology Laboratories

Graduate School Regulations

GRADUATE SCHOOL REGULATIONS

ADMISSION

For admission to the Graduate Programs, applicants must have a bachelor's degree from an accredited program in the appropriate field. A personal interview with the Director of Graduate Education Programs is required of all students wishing to enter any of the programs. A transcript of the applicant's prior college training should be presented at that time; if this is not possible, such material should be filed within six weeks after registration. No second registration will be allowed, nor will any grades of courses taken in the first registration period be issued until a transcript has been received and reviewed.

REGISTRATION

At the beginning of each semester, all students must register in the Graduate School office at the times indicated on the calendar.

Students in the evening part-time program, after a review of their transcript, will be classified as regular or special.

Regular Students: Students who have a bachelor's degree from an accredited program with acceptable quality of undergraduate work are designated as Regular Students.

Special Students: Students whose undergraduate record is not acceptable for regular classification are designated as Special Students.

DEGREE CANDIDACY

Admission to a course or courses does not constitute acceptance as a candidate for a Master's degree.

A student who has achieved regular classification and who has completed twelve credits of required courses in his major with a grade of B will be admitted to degree candidacy.

REQUIREMENTS FOR THE DEGREE OF MASTER OF EDUCATION

The programs for students without a teaching certificate require 34 semester hours of work including six semester hours of practice teaching. The programs in School Guidance, Special Education, and School Psychology require 34 semester hours credit including four semester hours of practical experience. All other programs require 30 semester hours of work and a minimum of twelve courses.

By special arrangements with the Director of Graduate Education programs a thesis may be approved to the extent of four semester hours credit.

STUDENT TEACHING

1. The prerequisite courses for starting practice teaching are:

Elementary Teaching

21.301 Child Psychology

21.305 Psychology of Learning and Thinking

or

21.306 Advanced Psychology of Learning and Thinking

21.220 Principles of Teaching

Two specialized methods courses.

Secondary Teaching

21.303 Adolescent Psychology

21.305 Psychology of Learning and Thinking

or

21.306 Advanced Psychology of Learning and Thinking

One specialized methods course.

2. Applications for student teaching must be filed by June 1 for assignments in the Fall semester and by November 1 for assignments in the Spring semester.

3. All placements are made by the Director of Student Teaching. Students are not permitted to make any independent arrangements with school systems.

4. Student teachers must complete 15 consecutive weeks of full-time experience in a public school.

STUDY LOAD

All graduate students are limited to a program of six semester hours of course work per semester unless granted special permission by the Committee on Graduate Study in Education to carry a heavier course load. Thus, those who carry two courses a semester continuously for

both semesters may complete the requirements of thirty semester hours for the degree within three years. Some students may find it possible to shorten this period by enrolling in the Summer Sessions.

GRADING SYSTEM

The performance of students in graduate courses will be recorded by the instructor by use of the following grades:

A Excellent

This grade is given to those students whose performance in the course has been of very high graduate caliber.

B Satisfactory

This grade is given to those students whose performance in the course has been at the level necessary for graduate credit.

C Fair

This grade is used to indicate that the student's performance in the course may be acceptable but is not consistently at the level expected in graduate work.

F Failure

This grade is used to indicate unsatisfactory work.

In addition, the following letter designations are used:

E Course registration canceled for nonattendance.

I Incomplete, without quality designation.

This is used when a student does not take the final examination or otherwise fails to complete the work of the course.

S Satisfactory, without quality designation.

This is used for student teaching and the practical experience in guidance and psychology.

W Withdrawn without prejudice.

An average of not less than B must be obtained in thirty course credits in order to qualify for the master's degree. If a grade of F is obtained in a required course, the course must be repeated and a grade of B or better obtained. If a grade of F is obtained in an elective course, this course may either be repeated or another elective course substituted for it. In the case of a repeated elective course, a grade of B must be obtained. A maximum of thirty-four course credits may be undertaken in qualifying for the degree.

The designation "I" will be changed to a grade upon removal of the "I" provided deficiencies are made up by the end of the semester follow-

ing the one in which the "I" was reported. If the course deficiencies are not made up within the specified time, the grade of "I" will automatically become a grade of F. Missed final examinations cannot be made up without the approval of the Dean or Director of the program involved. Approval for such make-up is given only for emergency reasons and must be obtained within one month following the date of the missed examination.

WITHDRAWALS

No withdrawal from a course is allowed after the tenth class session. Any student who is absent from three class periods in succession without excuse is dropped from the class.

The University provides all instruction and accommodations on an academic semester basis; therefore, no refunds are granted except in cases where students are compelled to withdraw because of personal illness or other reasons beyond their control. A student must complete an official withdrawal application at the Graduate School office before being considered for a refund. In no case are refunds made after a student has attended the fifth session of a class. Questions regarding refunds should be discussed with the Bursar's office.

TIME LIMITATIONS

Course credits earned in the program of graduate study are valid for a maximum of eight years. This time limitation is likewise applicable to any offered transfer credits.

TRANSFER OF CREDITS

Not more than eight semester hours of graduate credit may be transferred from other institutions towards the degree of Master of Education at Northeastern. Grades in courses offered for transfer must be B or higher. Acceptance of credits for transfer will not be approved until the student is admitted to candidacy, and then only if the work submitted for transfer credit is consonant with the objective of the approved program.

TUITION AND FEES

The policies governing the amount and the regulations pertaining to the payment of tuition and fees are established by the Executive Council of Northeastern University. The Council reserves the right to change these regulations at any time. Such changes will apply to students currently enrolled as well as new applicants for admission.

1. Schedule of Tuition and Fees

Registration Fee — for full time students payable at time of first registration	\$10.00
Matriculation Fee — for part-time students who have established degree candidacy	10.00
Tuition — per course for graduate credit	60.00
for six semester hours of practice teaching	90.00
Late Payment Fee — for failure to pay tuition on specified date	2.00
Make-up Final Examination Fee	5.00
Graduation Fee — payable on or before May 1 of year in which student expects to be graduated	20.00

2. Payments

Tuition statements will be mailed to the students by the Student Accounts office and are payable on or before the date specified.

Checks should be drawn payable to "Northeastern University."

VETERANS

Veterans who expect to obtain educational benefits from the Veterans Administration should visit the Northeastern University Veterans office, Room 245, Richards Hall, prior to registration. The Veterans office at Northeastern University is operated by the University and is prepared to give any assistance the veteran may require in obtaining Veterans' benefits.

CLASS HOURS, INSTRUCTIONAL CALENDAR

During the first and second semesters each course meets one evening per week for two hours for sixteen weeks, including the final examinations. In the summer session each course meets twice a week for a period of eight weeks. For opening and closing dates of these sessions, consult the Academic Calendar of this Bulletin.

INTERVIEW AND REGISTRATION DATES, OFFICE HOURS, AND CLASS SCHEDULES

For dates of the interview and registration periods and office hours, consult the inside front cover. The registration circulars issued in August, January, and May provide information regarding class meeting times and teaching staff as well as listing the course offerings for the first semester, second semester, and summer session, respectively. Copies of these circulars may be obtained from the office of the Director of Graduate Education Programs, Northeastern University, Boston 15, Massachusetts, or by calling COpley 7-6600.

**Curricula
and
Course Descriptions**

The curricula of the various degree programs are given under each departmental heading. The descriptions of courses offered by the several departments are given so that prospective students may obtain a view of the course coverage. Preparation courses are indicated in each instance. Not all courses are offered every year, but the course offerings will be arranged in such a manner that students may make continuous progress toward the degree.

The number of students enrolled in each class will be limited to permit effective teaching at the graduate level, and the University reserves the right to cancel any course for which an insufficient number of students apply.

In some courses one-semester hour credit is awarded for the work represented by a class meeting for one hour each week for one regular sixteen-week semester. In other courses one and one-half hours' credit are awarded for the work represented by a class meeting for one hour each week for one regular sixteen-week semester. The credits for each course are designated in the following section.

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GRADUATE PROGRAMS

SPECIALIZED PROGRAMS

Degree: Master of Education

Admission Requirements: A Bachelor of Science or Bachelor of Arts degree from an accredited institution and a teacher's certificate.

GENERAL REQUIREMENTS

All students are required to complete the four courses listed under A below. In addition, each student is required to select six credits of professional core courses listed under B below.

A			
21.401	Social Foundations of Education		3
21.402	Social Foundations of Education		3
21.306	Advanced Psychology of Learning and Thinking		3
21.340	Research Methods in Education		3
			—
			12
B			
School Administration:	21.201	Fund. of Administration I	3
	21.202	Fund. of Administration II	3
			—
			6
School Guidance:	21.371	Fund. of Guidance I	3
	21.372	Fund. of Guidance II	3
			—
			6
Special Education and			
School Psychology:	21.351	Sp. Ed. of Excep. Children I	3
	21.352	Sp. Ed. of Excep. Children II	3
			—
			6

ELECTIVE PROFESSIONAL COURSES

Twelve credits of professional courses must be elected unless Liberal Arts courses are substituted to the extent of four semester hour credits. The following preferred electives are recommended:

School Administration:	21.205	Admin. of the School Unit I	2
	21.206	Admin. of the School Unit II	2
	21.304	Mental Health	2
	21.216	Super. of Instr. in the Sec. School	2
		or	
	21.217	Super. of Instr. in the El. School	2
	21.422	American Gov. and Ed.	2
School Guidance:	21.322	Tests and Measurements	2
	21.374	Counseling	2
	21.304	Mental Health	2
	21.373	Occupational Information	2
	21.323	Meas. of Intelligence	2
	21.324	Adv. Meas. of Intelligence	2
Special Education:	21.323	Meas. of Intelligence	2
	21.324	Adv. Meas. of Intelligence	2
	21.355	An. of Read. Disabilities	2
	21.357	Teaching the Slow Learner	2
	21.358	Teaching the Gifted Child	2
School Psychology:	21.307	Abnormal Psychology I	2
	21.308	Abnormal Psychology II	2
	21.320	Statistics	2
	21.322	Tests and Measurements	2
	21.323	Meas. of Intelligence	2
	21.324	Adv. Meas. of Intelligence	2

LIBERAL ARTS COURSES

Certain Liberal Arts courses given in the Arts and Science Programs are available for electives. A maximum of 18 credits in this field may be taken by special permission of the Director of the Graduate Education Programs.

ADDITIONAL REQUIREMENTS

The programs in School Guidance, Special Education, and School Psychology require field experience in addition to the professional and elective courses to complete a total of 34 semester hour credits. These requirements can be met by the following courses when such field experience has already been satisfied:

School Guidance:	21.375	Field Experience in Guidance	4
Special Education:	21.325	Field Experience in Psychology	4
School Psychology:	21.325	Field Experience in Psychology	4

FIFTH-YEAR PROGRAMS FOR TEACHER PREPARATION**CURRICULA FOR STUDENTS WITHOUT A TEACHING CERTIFICATE**

The teacher certificate requirements of the Commonwealth of Massachusetts are as follows. Students meeting these requirements can obtain provisional certification in the other northeastern states.

Elementary School Teacher
Kindergarten through Grade VIII

1. A bachelor's degree or a diploma from a four-year course in a normal school approved by the Board of Education.

2. Included in each candidate's program of preparation there shall be a minimum of eighteen semester hours in education courses approved for the preparation of elementary school teachers, with not less than two semester hours in supervised student teaching in the elementary grades. The remaining semester hours shall include courses covering two or more of the following areas:

Educational Psychology, including Child Growth
and Development

Philosophy of Education

Methods and Materials in Elementary Education

Curriculum Development in Elementary Education

Secondary School Teacher
Junior High School Teacher

1. A bachelor's degree or a diploma from a four-year course in a normal school approved by the Board of Education.

2. Included in each candidate's program of preparation there shall be a minimum of twelve semester hours in education courses approved for the preparation of secondary school teachers, with not less than two semester hours in supervised student teaching in the secondary schools. The remaining semester hours in secondary education shall include appropriate courses in two or more of the following areas:

Educational Psychology, including Adolescent
Growth and Development

Philosophy of Education

Methods and Materials in Secondary Education

Curriculum Development in Secondary Education.

3. At least eighteen semester hours of preparation at the college level in the major subject field or fields, and nine semester hours in the minor subject field or fields.

Programs in elementary and secondary education are available for students who wish to obtain a Master of Education Degree and also complete the above professional requirements. These programs require 34 semester hours credit, of which six must be practice teaching. All students are required to complete the six courses listed below. The required additional courses for each program are listed under B below.

A

21.401	Social Foundations of Education	3
21.402	Social Foundations of Education	3
21.306	Advanced Psychology of Learning and Thinking	3
21.340	Research Methods in Education	3
21.220	Principles of Teaching	3
21.230	Student Teaching with Related Seminar	6
		—
		21

B

Elementary Teaching:	21.212	Curric. of the Amer. Elem. School	3
	21.301	Child Psychology	2
		Four courses in specialized methods	8
			13
Secondary Teaching:	21.210	Curric. of the Amer. Sec. School	3
	21.303	Adoles. Psychology	2
	21.322	Tests and Measurements	2
		At least one course in specialized methods	2
		At least two electives	4
			13

DESCRIPTION OF COURSES

21.200 Fundamentals of Administration (Offered summer 1961)

Course Content: A combination of courses 21.201 and 21.202

Credit: 6 semester hours

21.201 Fundamentals of Administration I (Offered yearly, 1st sem.)

Course Content: Designed for those planning to enter administration as well as teachers, principals, and school administrators, this course offers a thorough discussion and analysis of modern administrative practices. Local, state, and federal relationships in the structure of American education; the expanding role of the administrator; supervision and the improvement of instruction; and the field of special school services will be included.

Credit: 3 semester hours

21.202 Fundamentals of Administration II (Offered yearly, 2nd sem.)

Course Content: Problems associated with the planning, construction, and operation of the school plant; financing education; business management; and the increasingly important area of public relations will be considered. The course should be of particular interest and value to teachers and administrators who are concerned with improving professional competence and promoting effective teamwork in the administration of a school system.

Credit: 3 semester hours

21.205 Administration of the School Unit I (Offered yearly, 1st sem.)

Course Content: The school principalship will be placed in focus as a key position in public education. Among other points of emphasis involving the complex role of the principal will be the development of competencies in building management, the analysis and improvement of the educational program, and the selection and development of personnel. The course will be of sufficient breadth to be of assistance to teachers as well as those presently serving in the fields of administration and supervision.

Credit: 2 semester hours

21.206 Administration of the School Unit II (Offered yearly, 2nd sem.)

Course Content: The total responsibilities associated with school principalships will be considered in this course. Administrative principles applying to both the elementary and secondary levels will be discussed. Special emphasis will be placed on meeting the educational needs, guidance, curriculum evaluation and revision, business management, extracurricular activities, administering the school plant, and interpreting the school program to the community. The course is designed to serve those preparing to become principals, as well as to guide administrators in the field.

Credit: 2 semester hours

21.208 Administration of the School Unit (Offered summer 1962)

Course Content: A combination of courses 21.205 and 21.206

Credit: 4 semester hours

21.210 Curriculum of the American Secondary School

(Offered yearly, 2nd sem., and summer 1960)

Course Content: This course is designed for in-service and prospective teachers, principals, and supervisors who seek experience and assistance in dealing with such problems as the following: improving and enriching the subject curriculum; developing a core curriculum; general and special education; planning integrated units of work; providing for skill learning in an experience curriculum; co-operative development of criteria for curriculum evaluation; and effective use of evaluative criteria for secondary schools.

Credit: 3 semester hours

21.212 Curriculum of the American Elementary School

(Offered yearly, 2nd sem., and summer 1960)

Course Content: Consideration will be given to actual teaching situations as they exist in the modern elementary classroom, and emphasis will be placed on specific situations contributing to effective learning, sound curriculum-building, and evaluation. This course is open to teachers, supervisors, principals, and others interested in the modern elementary school program.

Credit: 3 semester hours

21.216 Supervision in the Secondary School (Offered yearly, 2nd sem.)

Course Content: This course is designed to meet the needs of those teachers seeking to prepare themselves for supervisory responsibilities as well as supervisors and administrators desiring to improve themselves. Major topics to be discussed are: the relationship between administrators and supervisors; the leadership role and responsibilities of the supervisor; mutual responsibilities between supervisor and faculty; personnel problems; discipline in the supervisory picture; types of supervision; relationship with other supervisors; curriculum improvement; teacher evaluation and professional guidance; and the psychological impact of supervision on the total educational framework and school administration.

Credit: 2 semester hours

21.217 Supervision in the Elementary School (Offered yearly, 1st sem.)

Course Content: This course will deal with the leadership role of the elementary school principal in the supervision of the instructional program. How the principal can work with individual teachers and with groups of teachers to improve instructional methods and to develop curriculum content will be

basic to the course. Consideration will be given, also, to the involvement of lay people in curriculum development. The course is intended for principals, beginning principals, and teachers who are planning to go into supervisory work.

Credit: 2 semester hours

21.220 Principles of Teaching

(Offered yearly, 1st and 2nd sem., and summer 1960)

Course Content: An exploration of the factors involved in effective teaching. Emphasizes the basic need for understanding of the learner and the learning process. Considers the improved methods of organization and evaluation in modern instructional programs.

Credit: 3 semester hours

21.230 Student Teaching with Related Seminar

(Offered yearly, 1st and 2nd sem.)

Preparation: See requirements under Graduate School Regulations.

Course Content: Here the student is provided opportunity in a public school to assume responsibility for organizing learning experiences in his major area under expert supervision. Separate seminars for elementary and secondary majors meeting weekly will run concurrently with the student teaching period and deal with problems encountered in the classroom.

Credit: 6 semester hours

21.241 Arithmetic and Its Teaching I (Offered 1961-62, 1st sem.)

Course Content: This course is designed to strengthen the elementary classroom teacher's understanding and appreciation of arithmetic. Special emphasis will be placed upon our decimal system of notation, meanings, relationships, and processes of the fundamental operations as well as problem analysis and estimation. At the same time, consideration will be given to the meaningful approach of teaching arithmetic to elementary school pupils and the methods involved.

Credit: 2 semester hours

21.242 Arithmetic and Its Teaching II (Offered 1961-62, 2nd sem.)

Course Content: A continuation of the study of elementary arithmetic, its meaning and practice, embracing problem-solving techniques and applying them to fundamentals of whole numbers, common and decimal fractions, percent, scaling and graphing, and measurements. Consideration will be given to topics and materials which serve to challenge the more able and ambitious pupils.

Credit: 2 semester hours

21.243 The Teaching of High School Mathematics

(Offered yearly, 1st sem.)

Course Content: This course covers a careful study of the place of mathematics in the senior high school curriculum. Attention is given to the aims, organization, and methods of teaching the subject. It is designed to give practical suggestions to senior high school teachers of mathematics and deals with real classroom problems. Trends in high school mathematics and accelerated programs for the fast learner will be considered.

Credit: 2 semester hours

21.244 The Teaching of Junior High Mathematics

(Offered yearly, 2nd sem.)

Course Content: Methods and materials for grades seven through nine in mathematics. The place and importance of general mathematics in the curriculum will be considered. Current trends in junior high mathematics and accelerated programs for the fast learner will be discussed.

Credit: 2 semester hours

21.245 The Teaching of High School Science I (Offered yearly, 1st sem.)

Course Content: The first half of a two-semester course, principally for secondary school teachers. Problems of observations of scientific facts, their discovery, the derivation of scientific principles from elaboration of hypotheses, experimentation and reasoning with these facts will be analyzed in terms of the learning processes. The different fields of science will be considered, stressing especially their interdependence and their unity of methods and of reasoning. Stress will be laid on recent advances in science and their relation to older discoveries. Particular attention will be paid to the background knowledge and preparation of the secondary school science teacher.

Credit: 2 semester hours

21.246 The Teaching of High School Science II

(Offered yearly, 2nd sem.)

Course Content: A continuation of 21.245. During the second half of the course plans for modern science courses in various fields will be elaborated.

Credit: 2 semester hours

21.248 Workshop in Elementary Science (Offered summer 1960)

Course Content: Attention will be given to ways teachers may bring to their classrooms simple and effective projects, materials, and experiments in the various phases of science such as machines, weather, solar system, etc. Consideration will be given to field trips and other devices to strengthen the total integrated program at the elementary level.

Credit: 2 semester hours

21.249 The Teaching of Social Studies (Offered yearly, 1st sem.)

Course Content: A study of developments in methods, materials, and curriculum. Consideration will be given to such topics as the following: the teacher of the social studies; objectives of social studies instruction; social studies programs; controversial issues; current events; visual and auditory aids; field trips; evaluation. These and others will be studied in their relation to the experiences and interests of the members of the class. Particular emphasis on the role of the social studies in education for citizenship.

Credit: 2 semester hours

21.250 Workshop in Play Production (Offered summer 1960)

Course Content: A laboratory course designed to aid the public school teacher in selecting and preparing a play for production. Major topics to be discussed will be: the role of the director as a co-ordinator of activities; the responsibility of the director to analyze, block, design and rehearse the play; and the responsibility of the director to supervise the commercial aspects of dramatic activity.

Credit: 2 semester hours

21.251 The Teaching of Language Arts in the Elementary School

(Offered yearly, 1st sem.)

Course Content: Emphasis will be given to best ways to meet the general objectives of the four basic communication skills — reading, writing, speaking, and listening — and how each relates to the other in the development of children.

Credit: 2 semester hours

21.252 The Teaching of Reading in the Elementary School

(Offered yearly, 2nd sem.)

Course Content: This course will deal with factors which must be considered in the preparation of teachers of reading. Topics to be discussed will include important changes in the teaching of reading (methods and materials) and reasons for the changes. Reading readiness — what it is, and factors to be considered. Levels of instruction — how to plan a reading program for any grade.

Credit: 2 semester hours

21.253 The Teaching of Oral and Written Expression in the Secondary School (Offered yearly, 1st sem.)

Course Content: For teachers of all subjects. Classroom procedures to motivate pride in our mother tongue. Methods of attaining skill in the important language conventions, and in stimulating creative thinking. Discussion of problems of speaking and oral reading; of teaching straight thinking; of grow-

ing sentences; of vocabulary; of spelling; of punctuation. Reexamination and redirection of teaching methods.

Credit: 2 semester hours

21.254 The Teaching of Reading and Literature in the Secondary School

(Offered yearly, 2nd sem.)

Course Content: For all secondary school teachers. Study of improvement of reading speed and comprehension by revised study habits, proper motivation diagnostic tests, and appropriate materials. Surveys and discussions of developmental reading programs. Methods effective in intensive and extensive reading. Criteria for choosing literature and teacher qualifications essential to its effective presentation. Special suggestions in the teaching of fiction, drama poetry, non-fiction, and creative listening.

Credit: 2 semester hours

21.255 The Teaching of Modern Languages in the Secondary School

(Offered 1961-62, 1st sem.)

Course Content: This course intends to explore the degree to which educational theory and psychology of learning can be adapted to the teaching situation existing today in our complex public school organization. Through the workshop method and group discussions, the most effective types of class activities subject unit presentation, assignments, examinations, teaching aids, etc., will be considered. The needs and problems of the members of the class will determine the content and progress of the course.

Credit: 2 semester hours

21.257 The Unit-Project Method in Industrial Arts

(Offered summer, 1960)

Course Content: The organization of industrial arts topics into functional units is the basic technique for instructional improvement. Emphasis will be placed upon the development and implementation in the school shop of the pupil work materials of the unit. Also involved are the proper delimitation of the unit and the strategy to be employed by the teacher as a unit progresses. For practical value, members of the class will have experience in the organization of industrial arts topics into units. The exchange of unit developed will be encouraged for common benefit and wider experimentation.

Credit: 2 semester hours

21.260 Seminar in Problems in Industrial Arts Teaching

(Offered summer, 1961)

Course Content: Course will be addressed to a study of problem situation in Industrial Arts Education. Causes of problems arising in matters of instruction, course making, management, and administration will be analyzed.

Each student will be expected to submit a clearly defined problem which he intends to work on during the course. Such research problems, or field projects, will become the basis of seminar discussion.

Credit: 2 semester hours

21.261 The Teaching of General Business Subjects

(Offered yearly, 1st sem.)

Course Content: This course investigates current trends in the teaching of social business subjects, such as general business, economics, economic geography, business law, and consumer education. Objectives, nature of subject matter, teaching aids and devices, tests and measurements, textbooks, and supplementary materials are studied.

Credit: 2 semester hours

21.262 Improvement in Instruction in Business Skill Subjects

(Offered yearly, 2nd sem.)

Course Content: This course is offered to teachers who are interested in arriving at improved methods of teaching shorthand, typewriting, and transcription. Topics to be discussed include: prognosis, diagnosis, and remedial teaching; the development of speed and accuracy; the articulation of the business skill subjects with general educational subjects; use of audio-visual aids. Members of the class will be encouraged to submit their own successful teaching devices or their own individual problems in this field.

Credit: 2 semester hours

21.271 Technical Drawing and Descriptive Geometry

(Offered 1st sem. 1960-61)

Course Content: The course will develop the general principles underlying Multi-View Representation using the Direct Method and show applicability to all types of views (principal, auxiliary, oblique). The concepts of Descriptive Geometry dealing with space angularity, perpendicularity, parallelism, intersection, and skewness between lines, surfaces, and solids will be correlated with their pictorial and multi-view representations. Applications of these concepts to more general treatments of sections and intersections; surface developments; axonometric, oblique, and perspective pictorials; shades and shadows; as well as problems dealing with space vector systems; topographic layouts, etc., will be included. The major aim of the course will be toward placing the construction, analysis, reading, and visualization of three-dimensional concepts on a foundation of logic and reason.

Credit: 2 semester hours

21.272 Advanced Graphics (Offered 2nd sem. 1960-61)

Course Content: The course will develop methods by which the theorem and constructive techniques of plane, solid, and descriptive geometry may be applied in graphically representing, analyzing, and solving problems having mathematical or scientific implications. The following topics will be developed to a depth commensurate with the mathematical and scientific background of the participants: (a) basic geometric constructions (exact and approximate involving lines, curves, and polygons; (b) graphical equivalents to mathematical operations in arithmetic, algebra, trigonometry, analytic geometry and calculus; (c) graphical analysis of curves having scientific applications (conic sections, involutes, roulettes, periodic functions, etc.); (d) design construction, and application of charts (bar, rectilinear, logarithmic, polar trilinear, etc.) for the presentation and analysis of empirical data; (e) vector geometry solutions involving displacements, velocities, accelerations, forces relative motions, etc.; (f) elements of nomography, topographic mapping as well as spatial relationship problems of mathematical or scientific origin.

Credit: 2 semester hours

21.301 Child Psychology (Offered yearly, 2nd sem.)

Course Content: A study is made of the child as he develops from infancy through the elementary school years. The primary emphasis is upon his emotional, social, and intellectual development. Physical development is discussed only in its relation to these other factors. The child is considered in his home and peer environment as well as in the school environment. Case history material is studied. Some attention is paid to the theoretical formulations of child behavior.

Credit: 2 semester hours

21.303 Adolescent Psychology

(Offered yearly, 1st sem. and summer 1960)

Course Content: Social, emotional, and intellectual development is traced through the junior and senior high school years. Problems in family relationships and in the adolescent's social environment are considered as well as his adjustment in school. Case history material is included.

Credit: 2 semester hours

21.304 Mental Health (Offered yearly, 2nd sem.)

Course Content: This course will study conditions leading to the most effective social adjustment. Consideration will be given to the relationship between the maturation process and mental health, the predeterminants of maladjustment and its prevention, and will place special stress on those factors that encourage the attainment of emotional maturity. Some time will be given to a study of community mental health programs. Information bearing on mental health from the fields of psychiatry, psychology, sociology

physiology, and medicine will be synthesized and evaluated. This course should be of interest to teachers, personnel and guidance workers, psychologists, social workers, rehabilitation therapists, and other groups.

Credit: 2 semester hours

21.305 Psychology of Learning and Thinking

(Offered yearly, 1st and 2nd sem., and summer 1960)

Course Content: This course is designed to introduce the public school teacher and the educational administrator to the more important psychological principles and processes involved in effective learning and thinking. Consideration is given to such topics as productive thinking, kinds of learning, the role of organizational factors in effective learning, problem-solving behavior, and concept formation.

Credit: 3 semester hours

21.306 Advanced Psychology of Learning and Thinking

(Offered yearly, 1st and 2nd sem.)

Preparation: 21.305 or its equivalent

Course Content: This course will deal more intensively, and at a more advanced level, with some of the material introduced in 21.305. Additionally, consideration will be given to such topics as emotional and motivational factors in learning, processes involved in retention and forgetting, the development of language, and classroom climate. Pertinent research and theories in the various areas will be examined, and the student will participate in classroom discussion and presentation of the various topics.

Credit: 2 semester hours

21.307 Abnormal Psychology I (Offered yearly, 1st sem.)

Course Content: This is a two-semester course designed for educators and others concerned with the ways in which personality may become disordered. A careful survey of theories of personality development will serve as a base for discussing the malfunctioning personality as seen in the possible types of problems that may occur at various levels of development. Particular attention will be paid to problems of a neurotic nature and the types of defensive processes and attempts at problem solution that are noted. Case studies and films will serve as illustrations wherever possible.

Credit: 2 semester hours

21.308 Abnormal Psychology II (Offered yearly, 2nd sem.)

Preparation: 21.307 or its equivalent

Course Content: This course will continue to examine the etiology and symptoms of the more serious personality disorders. Such problems as conduct disorders, psychosomatic disorders, and psychoses will come under

discussion. The current methods of clinical diagnosis and treatment will be reviewed. Case studies will be integrated with lectures and discussed.

Credit: 2 semester hours

21.309 Group Development (Offered yearly, 1st sem.)

Course Content: Emphasis in this course will be directed toward understanding the deeper questions of group growth, behavior, and action fundamental to developing solutions to the complex problems of group life. Students will learn to act as a group, to act democratically, to examine their strengths and weaknesses, to make group decisions, to become alert to new ideas and actions, to discover the pulse of a group and why one group is productive while another is non-productive. The group will examine intensively such areas as group process, sociodrama, sociometric techniques, attitude testing, social action project development, and communication blocks in human relations.

Credit: 2 semester hours

21.312 The Emotionally Disturbed Child (Offered 2nd sem. 1961-62)

Course Content: Educators will study identification techniques for regular classroom use. Diagnostic procedures and referral agencies will be explored. Skills to be employed in helping the emotionally disturbed child who remains in the regular classroom will be developed. An analysis will be made of problems of administration and participation in a team situation where emotionally disturbed children function in a segregated group.

Credit: 2 semester hours

21.320 Statistics (Offered 2nd sem. 1960-61)

Course Content: A first course in the statistical techniques used in educational research and in psychological testing. Measures of central tendency, variability, correlation, chi square, analysis of variance, and multiple regression will be among the topics considered. The student's mathematical background need not be beyond elementary algebra.

Credit: 2 semester hours

21.322 Tests and Measurements (Offered yearly, 2nd sem.)

Course Content: The principles and problems of psychological testing as applied to the field of education are discussed. Some consideration is given to elementary statistical concepts as they apply to test construction and the general problem of evaluation. Consideration is given to the proper selection of tests for classroom and system-wide use. The student is made familiar with some of the currently used tests. The Stanford-Binet and Wechsler-Bellevue represent intelligence testing; the Metropolitan Achievement Tests, the Iowa Silent Reading Tests, Differential Aptitude Tests, and the American Council on Education Psychological Examination are considered as group evaluations; the Strong and Kuder Inventories are considered as

interest measurements. A very brief introduction is given to questionnaire and projective types of personality assessments. Attention is given to the improvement of teacher-made tests, and the student spends some time in the construction of an achievement test in his own area of interest.

Credit: 2 semester hours

1.323 Measurement of Intelligence (Offered yearly, 1st sem.)

Preparation: 21.322 Tests and Measurements or approval of instructor

Course Content: Deals with the nature of intelligence and its individual measurement using standardized techniques. Major emphasis is on the administration, scoring, and interpretation of the Stanford-Binet (Form L), and a certificate will be issued to those who complete the testing requirements under supervision. Other individual tests will be discussed, including the Wechsler Scales; and consideration will be given to the intellectual evaluation of individuals presenting special problems.

Credit: 2 semester hours

1.324 Advanced Measurement of Intelligence

(Offered yearly, 2nd sem.)

Preparation: The Measurement of Intelligence and evidence of competency with the Stanford-Binet Scale.

Course Content: Deals with the individual measurement of intelligence utilizing the Wechsler Scales. Major emphasis is on the administration, scoring, and interpretation of these scales, and a certificate will be issued to those students who complete the testing requirements under supervision. Consideration will be given to the intellectual evaluation of individuals presenting special problems and to the adjunct diagnostic features of the Wechsler Scales.

Credit: 2 semester hours

1.325 Field Experience in Psychology

Preparation: Arrangement for this experience is made by consultation with the Director of Graduate Study in Education.

Course Content: Persons wishing to concentrate graduate study in the field of School Psychology and who may never have been employed in such service must acquire 120 or more hours of such experience by working under supervision in an approved school psychology program.

Credit: 4 semester hours

1.340 Research Methods in Education

(Offered yearly, 1st and 2nd sem., and summer, 1960)

Course Content: Emphasis will be placed upon approaches to the study of educational problems. Students will review elementary statistical concepts. Factors involved in the selection and formulation of a research problem as well as in the collection, scaling, and interpretation of data will be explored.

Attention will be given to the conduct of controlled experiments, surveys exploration studies, historical research, and action research projects, with stress being placed upon the preparation of the report and the practical application of findings. Guides to references in special areas will be reviewed

Credit: 3 semester hours

21.351 The Nature, Management, and Special Education of Exceptional Children (Offered yearly, 1st sem.)

Course Content: A two-semester survey course for educators and all others concerned with one or more aspects of exceptional children. It will involve a study of the nature, etiology, diagnosis, treatment, and special education of the various problems of these children. This half of the course deals with physical handicap, visual impairment, organic disorders, brain injury, speech disorder, and hearing impairment. Lectures, discussions, clinical demonstrations, and films provide greater appreciation, understanding, and insight into the manifold problems of the exceptional child.

Credit: 3 semester hours

21.352 The Nature, Management, and Special Education of Exceptional Children (Offered yearly, 2nd sem.)

Course Content: This half of the course deals with intellectual deviate (both gifted and retarded), reading disabilities, behavior and emotional disorders, vocational problems, delinquency, and a consideration of the psychological aspects of visual impairment.

Credit: 3 semester hours

21.353 Introduction to Speech and Hearing (Offered 1st sem. 1960-61)

Course Content: A consideration of the fundamentals of normal speech development and the hearing process; etiological factors, symptomatology, and classification of speech and hearing disorders; speech improvement versus speech therapy; the basic concepts underlying the problems of the speech handicapped, the hard of hearing, and the deaf; an orientation course for teachers, school administrators, psychologists, social workers, and nurses.

Credit: 2 semester hours

21.354 Applied Phonetics (Offered 1961-62, 2nd sem.)

Course Content: A survey of past and present phonetic systems; acquisition and application of the International Phonetic Alphabet; analysis of the vowel and consonant sounds of American English with phonetic transcription of typical and individual speech; the place of phonetics in speech and hearing therapy; the variables affecting standards for speech sounds and pronunciation.

Credit: 2 semester hours

1.355 Analysis and Treatment of Reading Disabilities

(Offered yearly, 1st sem., and summer, 1960)

Prerequisite: 21.350 and 21.351, or teaching experience, or courses in child psychology, or courses in reading.

Course Content: A consideration of reading problems in terms of types of deviations from the normal reading process. The course will include discussion of the nature of reading disabilities, their causes, methods of diagnosis, and methods of remediation.

Credit: 2 semester hours

1.356 Industrial Arts and Crafts for Special Classes

(Offered 2nd sem. 1960-61)

Course Content: Industrial Arts for Special Class teaching. A course in the use of tools and construction that will prepare a teacher for Special Class teaching. Will consider the building of a background knowledge of shop tools and their uses plus the practical shop experiences of working through some projects, both in wood-working and metal work. The equipment necessary for a Special Class Industrial Arts room will be listed, and experience in use of such equipment will be provided.

Credit: 3 semester hours

1.357 Teaching the Slow Learner (Offered summer, 1960)

Course Content: A study of the types of slow-learning children — the mentally retarded, the educationally retarded, the emotionally handicapped children who are enrolled in the regular classrooms — with emphasis on the adaptation of the curriculum to effect an adequate adjustment for these children. Other aspects to be studied will be the diagnosis and classification of retarded children; the help from the home, the church, and other community resources; the extent of therapy in the school program; a study of the psychology of the retarded child in relation to a flexible curriculum for his growth and development.

Credit: 2 semester hours

1.358 Teaching the Gifted Child (Offered 2nd sem. 1961-62)

Course Content: A study of the research on the gifted child will be made, including the physical, social, and emotional development of such children. Means of identifying the gifted child will be presented. The various methods of providing adequate educational opportunities will be reviewed such as: enrichment, segregated classes, acceleration, and special programs.

Credit: 2 semester hours

1.359 Domestic Arts for Special Classes (Offered summer, 1960)

Course Content: A course for teachers of Special Classes to help them become prepared to teach and integrate a Domestic Arts program in the total cur-

riculum of the retarded child. The practical aspects of buying, food preparation, serving, and preservation will be studied. Clothing will cover the areas of buying, mending, sewing and laundering. Good health practices in the home will be outlined, and means of correlating these learnings into the total program will be developed.

Credit : 2 semester hours

21.370 Fundamentals of Guidance (Offered summer, 1960)

Course Content : A combination of courses 21.371 and 21.372.

Credit : 6 semester hours

21.371 Fundamentals of Guidance: Basic Concepts

(Offered yearly, 1st sem.)

Course Content : The purpose of this course will be to examine critically basic concepts and techniques of school guidance. The role of the teacher administrator, and guidance specialist will be explored through the analysis of individual case problems encountered at elementary, secondary, and post secondary school levels. Attention will be directed to practices of gathering information about individuals and giving aid to them through individual counsel and related activities.

Credit : 3 semester hours

21.372 Fundamentals of Guidance: Programs and Policies

(Offered yearly, 2nd sem.)

Course Content : A review of student personnel programs in local schools and colleges will be related to an analysis of merging trends of guidance policy and practice in the modern American school. Divergent trends in counseling and recent research in the areas of occupational choice and juvenile delinquency will provide a basis for evaluating the qualifications and responsibilities of school guidance personnel and the place of guidance in the school curriculum.

Credit : 3 semester hours

21.373 Occupational Information (Offered summer, 1960)

Course Content : This course is designed to serve as a background for teachers and counselors. The following areas of occupational information will be emphasized: occupational trends in relation to social and economic changes, classification and description of job opportunities, collecting and evaluating occupational information, and compilation and maintenance of files on occupational source materials.

Credit : 2 semester hours

21.374 Counseling (Offered yearly, 2nd sem.)

Course Content : This course is planned to give teachers an understanding of

counseling theories and to provide elementary proficiencies in counseling students on problems of educational, vocational, social, and emotional adjustment. Typical case materials will be presented to the class for analysis and discussion. Members of the class will participate in counseling sessions.

Credit: 2 semester hours

1.375 Field Experience in Guidance

Preparation: Arrangement for this experience is made by consultation with the Director of Graduate Study in Education.

Course Content: Persons wishing to concentrate graduate study in the field of guidance and who may have had no experience in guidance work in the schools can acquire 120 hours or more of such experience by working under supervision in the Testing and Counseling Center of the University and/or in a guidance program in a public school.

Credit: 4 semester hours

1.400 Social Foundations of Education (Offered yearly, summer)

Course Content: A combination of courses 21.401 and 21.402.

Credit: 6 semester hours

1.401 Social Foundations of Education (Offered yearly, 1st sem.)

Course Content: A course designed to increase understanding of human behavior and to develop objectivity and perspective in viewing society. Human personality will be viewed in its dynamic aspects and in relationship to group influences. The American school will be analyzed as a social institution within the broader framework of a dynamic social system.

Credit: 3 semester hours

1.402 Social Foundations of Education (Offered yearly, 2nd sem.)

Course Content: Investigation of contemporary trends and issues and analysis of personal and social problems in American society. Emphasis will be placed upon critical analysis of American ideals and values and the role of the school in a democratic society.

Credit: 3 semester hours

1.403 Personality in Culture (Offered 1960-61, 2nd sem.)

Course Content: In this course consideration will be given to the development of personality in a number of different cultures. The role of constitutional, physiological, cultural, and social factors will be emphasized. Attention will be given to the variety of ways in which men satisfy their strivings within different cultural patterns. The conclusions reached in the study of personality development in other cultures will be applied to the educational processes in our society.

Credit: 2 semester hours

21.410 The Impact of Science on Civilization

(Offered summer, 1961)

Course Content: This course will deal with the impact of science on various phases of our civilization such as production and consumption of food, health of individuals, and medicine, public health, populations and their growth, utilization of natural resources, production of energy and its utilization, problems of education. The course is intended to provide extensive scientific and unified bases for study by teachers who are interested in introducing the concepts of unified sciences in their teaching.

Credit: 2 semester hours

21.411 Electronics for Teachers (Offered 1960-61, 2nd sem.)

Course Content: This course is designed to cover electronic developments in recent years that are of interest to high school students of science. A review of the principles of various electron tubes, and the superheterodyne receiver plus radio-telephone transmitters will be followed by studies in radar, recording and reproduction of speech and music, television, and the more important uses of electron tubes in industrial electronics and aircraft devices.

Credit: 2 semester hours

21.422 American Government and Education

(Offered 1961-62, 2nd sem.)

Course Content: A study of the relationship of government and education in a democratic society. After considering the historical role of American Government in education, special emphasis will be given to such contemporary problems as academic freedom, federal aid to education, fiscal policy, segregation, and separation of church and state.

Credit: 2 semester hours

21.435 Semantics for Teachers (Offered 1961-62, 1st sem.)

Course Content: The implications for education of the new discoveries in linguistics, theory of communication, and general semantics. Among the topics to be included will be techniques for training more mature thinkers, better communication, reading and listening for meaning, more alert observation, etc. The course will describe principles and techniques useful for teachers at any age-level of the schools and will include methods for the teacher to improve his own evaluation and communication.

Credit: 3 semester hours

21.451 Workshop in Arts and Crafts (Offered summer 1960)

Course Content: A course designed to aid in the teaching of Arts and Crafts to all children including special classes. Emphasis will be on the creation of designs and the technique of their practical application to objects of everyday use.

ay use as interpreted in various media related to stenciling, linoleum-block printing, glass decoration, mosaics, collage, pen lettering, papier-mâché, rayons, etc. Instruction will be flexible enough to suit the needs of each member enrolled. No past experience is necessary.

Credit: 2 semester hours

21.474 History of Educational Thought (Offered summer, 1961)

Course Content: A combination of courses 21.475 and 21.476.

Credit: 4 semester hours

21.475 History of Educational Thought I (Offered yearly, 1st sem.)

Course Content: This course will examine educational theory and practice from antiquity to the Reformation. An attempt will be made to apply sociological and philosophical viewpoints to systems of education, beginning with primitive societies and continuing through Oriental civilizations, the classical period of Greece and Rome, the early and medieval Christian eras, the Renaissance period, and the Reformation.

Credit: 2 semester hours

21.476 History of Educational Thought II

(Offered yearly, 2nd sem.)

Course Content: A continuation of 21.475. The course deals with the development of educational theory and practice from the time of the Reformation to the present. Among the topics considered are: the transition from humanism to realism in education; rationalism and naturalism, as these are reflected in education; psychologizing education; the growth of the curriculum; the "new" education.

Credit: 2 semester hours

21.477 Philosophy of Education (Offered 1st sem., 1960-1961)

Course Content: This course will analyze the various philosophies of education with reference to their historical background and with particular emphasis upon their relation to contemporary educational practice. For example, the class will consider such themes as educational aims, values and curriculum; religious and moral education; intellectual freedom; the relationship between school and society, and between the school and the individual.

21.501 - 21.502 Thesis

Course Content: Original study under the direction of the department.

OFF-CAMPUS COURSES

Offered if there is sufficient demand in local communities. The contents of these courses are comparable to on-campus courses may be altered to fit particular requirements of local school system

21.330 Workshop in Mental Health

Credit: 2 semester hours

21.331 Workshop in Mental Health and Guidance

Credit: 2 semester hours

21.332 Seminar in Inter-Group Relations

Credit: 2 semester hours

21.333 Workshop in Human Relations

Credit: 2 semester hours

21.334 Seminar in Case Problems

Credit: 2 semester hours

21.335 Institute on Exceptional Children

Credit: 2 semester hours

NON-PROFESSIONAL ELECTIVE COURSES

ENGLISH

0.121 Principles of Literary Criticism (Offered 1960-61, 1st sem.)

Course Content: An examination of the basic principles of literary criticism as they appear in the work of major critics of classical antiquity and of English literature from the Renaissance to the present. The lectures stress Plato, Aristotle, Longinus, Sidney, Dryden, Johnson, Coleridge, Hazlitt, Arnold, and T. S. Eliot. The readings include the work of important minor critics. Assigned papers require practical application of the principles of criticism.

0.131 Grammatical Analysis (Offered 1961-62, 1st sem.)

Course Content: A consideration of the structural elements of sentences, the substituting of functions, and the principles of analysis. Punctuation is studied as a body of structural signals. Modern language patterns are viewed in the light of their historic development.

0.132 Introduction to Linguistics (Offered 1960-61, 2nd sem.)

Course Content: The aim of the course will be to acquaint the student with the more important principles of linguistics as a science. Phonetics, phonemes, and phonology will receive considerable attention, as will also patterning, process, meaning, and others of the larger aspects of language. The approach will be descriptive and comparative. Reference and collateral work will be necessary.

0.140 General Semantics (Offered 1961-62, 2nd sem.)

Course Content: Meaning as a structural relationship involving language, thought, experience, emotion, and the world around us. The relationship of symbolism to reality and the analysis of language as communication and as determinant of culture and civilization. Applications from several fields, including literature, art, philosophy, and science.

GOVERNMENT

22.171 United States — Soviet Relations

(Offered 1961-62, 1st sem.)

Course Content: A study of the relations between the United States and the Soviet Union from 1917 to the present. Such topics as the Soviet political system, the "non-recognition" period, and the origins and nature of the present power conflict are stressed.

22.180 Nationalism (Offered 1961-62, 2nd sem.)

Course Content: An examination of the evolution and role of nationalism in contemporary international relations. Representative nationalistic movements and theories are covered.

22.190 Comparative Political Parties (Offered 1960-61, 2nd sem.)

Course Content: A comparative study of the background, organization, and function of political parties in contemporary democratic governments. The role and influence of two-party and multi-party systems in the democratic process are considered.

22.231 Seminar in United States Foreign Policy

(Offered 1960-61, 1st sem.)

Course Content: An examination of the role of the United States in world politics. Historical background, analysis of problems involved in policy formulation and execution, and specific contemporary issues are covered.

HISTORY

23.105 Intellectual History of Europe (1600-1800)

(Offered 1961-62, 1st sem.)

Course Content: The intellectual development of seventeenth and eighteenth century Europe, as a background to more recent thought, is the subject matter of this course. Political, scientific, and philosophic thought will be emphasized, though other aspects will be considered also. Theories of absolutism and popular sovereignty, Newtonian science, and the Age of Enlightenment will be developed in full.

23.106 Intellectual History of Europe (1800-1959)

(Offered 1961-62, 2nd sem.)

Course Content: This course is a continuation of 23.105 and as such will receive basically the same emphasis. It will treat extensively the various socialist movements and their conservative counterparts; non-socialist radical thought such as anarchism and nihilism; the growth of evolutionary theory; and the twentieth century.

23.115 Social and Economic History of Europe (1600-1815)

(Offered 1960-61, 1st sem.)

Course Content: This course deals with the development of the social and economic institutions of modern Europe. Beginning with the rise of capitalism and the age of exploration, it traces the expansion of colonialism and mercantilism, and their effect upon the growth of nationalism. The social and economic institutions of the great empires of Spain, France, and England, as well as the effects of the French Revolution, receive serious emphasis.

23.116 Social and Economic History of Europe (1815-1959)

(Offered 1960-61, 2nd sem.)

Course Content: This course is a continuation of 23.115. The social and economic trends that began with the Age of Enlightenment and the French Revolution are studied. The expansion of capitalism and imperialism; the rise of national states in Europe; the development of socialistic philosophies; the implications of the scientific discoveries of Charles Darwin; the origins and consequences of the two world wars; and the contemporary conflict between capitalism and communism are all emphasized.

GIFTS AND BEQUESTS

Northeastern University will welcome gifts and bequests for the following purposes:

- (a) For its building program.
- (b) For general endowment.
- (c) For specific purposes which may especially appeal to the donor.

It is suggested that, when possible, those contemplating gifts or bequests confer with the President of the University regarding the University's needs before legal papers are drawn.

The legal name of the University is "Northeastern University." However, in the making of gifts and bequests to Northeastern, the following wording is suggested: "Northeastern University, an educational institution incorporated under the laws of Massachusetts and located in Boston, Massachusetts."

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regarding any of the above schools or colleges, address

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360 Huntington Avenue, Boston 15, Massachusetts, COpley 7-6600



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GRADUATE SCHOOL

PROGRAMS IN BUSINESS ADMINISTRATION

CATALOGUE 1960-1961



BOSTON 15, MASSACHUSETTS

APRIL 1960

Interview Periods and Regular Sessions

1960 Summer Session

Interview Period	May 31-June 1
Registration Period	May 31-June 1
Regular Session	June 13-Aug.

1960-1961 First Semester

Interview Period	Aug. 29-Sept. 1
Registration Period	Aug. 29-Sept. 1
Regular Session	Sept. 19-Jan. 2

1960-1961 Second Semester

Interview Period	Jan. 16-Feb.
Registration Period	Jan. 16-Feb.
Regular Session	Feb. 6-June

1961 Summer Session

Interview Period	May 29-June 1
Registration Period	May 29-June 1
Regular Session	June 12-Aug.

REGULAR OFFICE HOURS

Monday through Friday	8:45 a.m.- 5:00 p.m.
Saturday	8:45 a.m.-12:00 noon

SPECIAL OFFICE HOURS DURING REGISTRATION PERIODS ONLY

Monday through Friday	8:45 a.m.- 8:00 p.m.
Saturday	9:00 a.m.-12:00 noon

The office is closed on all legal holidays.

Requests for Bulletins and information about graduate work in the Business Administration Programs should be addressed to

**DIRECTOR, BUSINESS ADMINISTRATION PROGRAMS
THE GRADUATE SCHOOL**

Northeastern University

360 Huntington Avenue, Boston 15, Massachusetts

Copley 7-6600

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PROGRAMS IN BUSINESS ADMINISTRATION

CATALOGUE 1960-1961



LEADING TO THE DEGREE OF
MASTER OF BUSINESS ADMINISTRATION

BOSTON 15, MASSACHUSETTS

APRIL 1960

GRADUATE PROGRAMS

AT

NORTHEASTERN UNIVERSITY



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Evening Programs leading to the Master of Business Administration degree.

EDUCATION

Late Afternoon, Evening, and Saturday Morning Programs leading to the Master of Education degree.

ENGINEERING

Co-operative Programs leading to the Master of Science degree in Chemical Engineering, in Civil Engineering with a major in Structures, in Mechanical Engineering with a major in Mechanics, and in Electrical Engineering.

Evening Programs leading to a Master of Science degree in Civil Engineering, Electrical Engineering, Communications, Engineering Management, Engineering Mechanics, and Mechanical Engineering.

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ACADEMIC CALENDAR

MAY 1960 - JUNE 1961

SUMMER SESSION 1960

Interview and Registration Period	Tuesday-Saturday	May 31-June 11
Classes Begin	Monday	June 13
Independence Day, No Classes	Monday	July 4
Classes End	Tuesday	Aug. 2
Examination Period	Wednesday-Thursday	Aug. 3-Aug. 4

FIRST SEMESTER 1960-1961

Interview and Registration Period	Monday-Saturday	Aug. 29-Sept. 17
Labor Day, Office Closed	Monday	Sept. 5
Classes Begin	Monday	Sept. 19
Columbus Day, No Classes	Wednesday	Oct. 12
Veterans' Day, No Classes	Friday	Nov. 11
Thanksgiving Vacation	One Week	Nov. 21-Nov. 25
Classes Resume	Monday	Nov. 28
Christmas Vacation	Two Weeks	Dec. 20-Jan. 2
Classes Resume	Tuesday	Jan. 3
Classes End	Friday	Jan. 20
Examination Period	Monday-Friday	Jan. 23-Jan. 27
No Classes	Monday-Friday	Jan. 30-Feb. 3

SECOND SEMESTER 1960-1961

Interview and Registration Period	Monday-Saturday	Jan. 16-Feb. 4
Classes Begin	Monday	Feb. 6
Washington's Birthday, No Classes	Wednesday	Feb. 22
Patriots' Day, No Classes	Wednesday	April 19
Classes End	Friday	May 19
Make-up for Classes Missed		
Wed., April 19	Wednesday	May 24
Examination Period	Monday-Friday	May 29-June 2

CALENDAR

APRIL 1, 1960 - JUNE 30, 1961

1960

APRIL

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1961

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APRIL

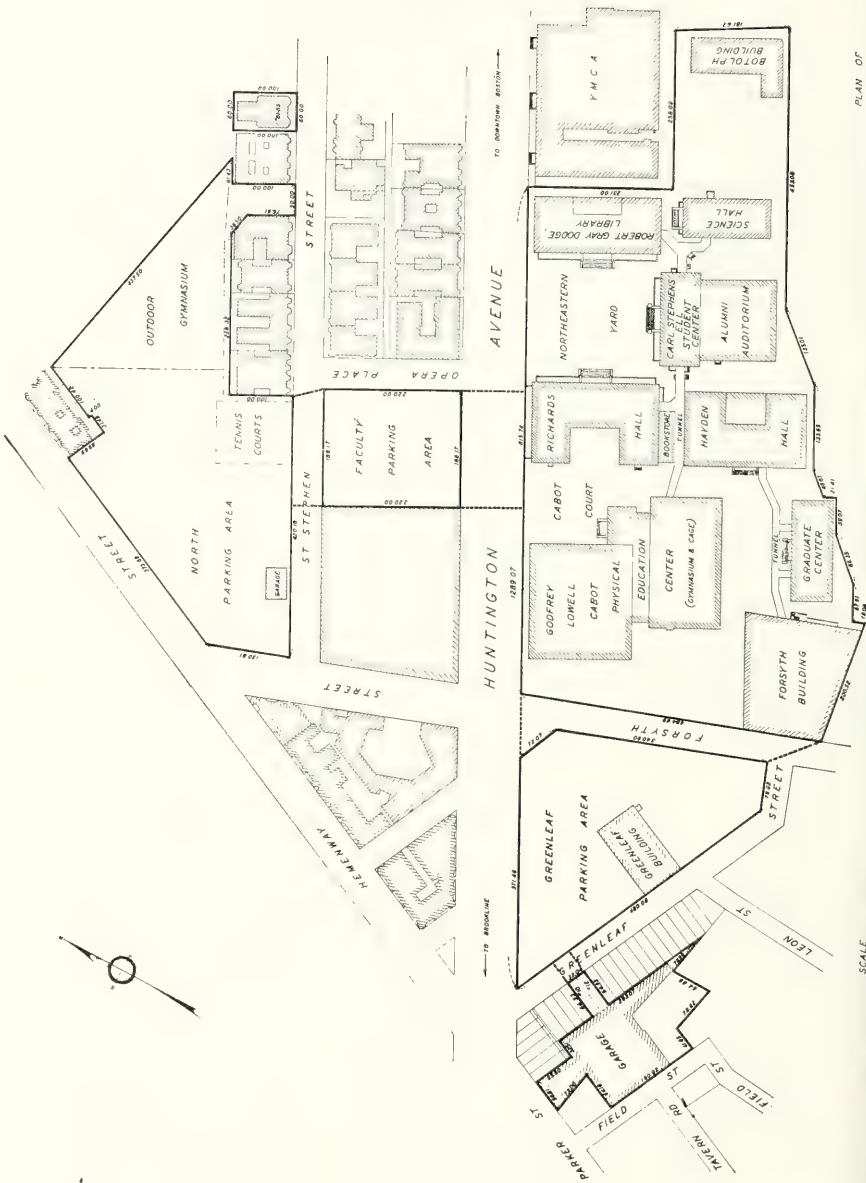
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MAY

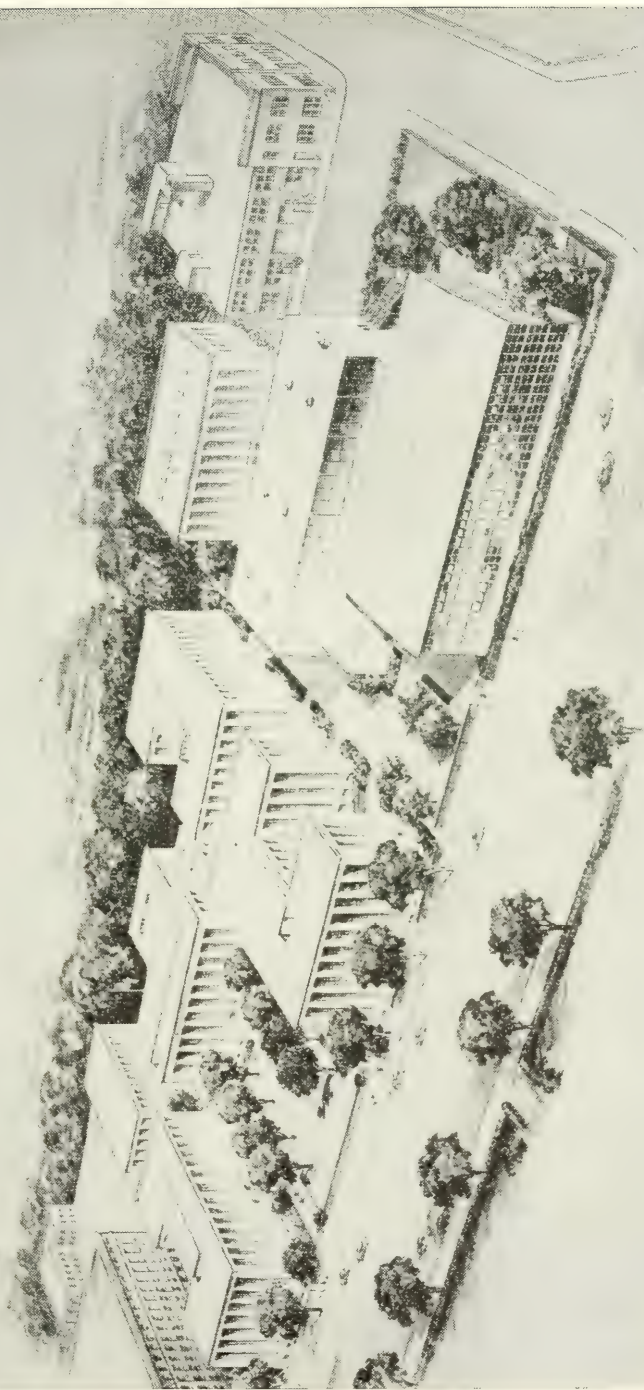
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Statistician, Federal Reserve Bank, Boston, Massachusetts

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The teaching staff of the Graduate Business Administration Program is composed of regular full-time faculty members of Northeastern University, members of the faculties of neighboring institutions, and persons employed in responsible business positions. The composition of the teaching staff during any particular school year is dependent upon the courses offered during that year. The teaching staff of the Graduate Business Administration Program includes the following:

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JOHN W. BAGWILL, JR.	<i>Staff Assistant, Planning, Raytheon Company</i>
CLIFFORD A. BEAN	<i>Market Analyst, Raytheon Company</i>
NEIL H. BORDEN, JR.	<i>Instructor in Marketing, Northeastern University</i>
STEPHEN G. BURKE	<i>Assistant to General Mgr., Walter Baker, Div. of General Foods</i>
JOSEPH CONNOLLY	<i>Assistant to Vice-President of Sales, Hickox Manufacturing Company</i>
RALPH G. DACEY	<i>Vice-President, Compo Shoe Machinery Corporation</i>
JOHN M. DUTTON	<i>Instructor in Management, Northeastern University</i>
PAUL J. ERICKSON	<i>Director of Center for Management Development, Northeastern University</i>
ROBERT EVANS, JR.	<i>Asst. Prof. of Industrial Relations, Mass. Inst. of Technology</i>
WILLIAM J. FROST	<i>President, Frost Development, Inc.</i>
FRANCIS C. GENOVESE	<i>Babson Institute of Business Administration</i>
ROMAN S. GORSKI	<i>Investment Consultant</i>
JOHN J. GRAHAM	<i>Attorney at Law</i>
DOUGLAS A. GREEN	<i>Industrial Consultant</i>
SIDNEY HERMAN	<i>Asst. Prof. of Economics, Northeastern University</i>
JULIAN E. JACKSON	<i>Prof. of Business Law, Northeastern University</i>
RUDOLPH A. JOHNSON	<i>Babson Institute of Business Administration</i>
GABRIEL T. KEREKES	<i>Babson Institute of Business Administration</i>

BARKEV KIBARIAN	<i>Asst. Prof. of Marketing and Advertising, Northeastern University</i>
IVORY L. LYONS	<i>Asst. Prof. of Economics, Northeastern University</i>
JOHN E. MARSHALL	<i>Babson Institute of Business Administration</i>
ERNEST MODERN	<i>Field Examiner, National Labor Relations Board</i>
PAUL NORTON	<i>Industrial Consultant</i>
PAUL L. POSTON	<i>Asst. Prof. of Management, Northeastern University</i>
SUMNER M. ROSEN	<i>Asst. Prof. of Economics, Northeastern University</i>
ANGEL N. RUGINA	<i>Assoc. Prof. of Economics and Finance, Northeastern University</i>
HARRY SAUNDERS	<i>Investment and Security Analyst, Hooper-Kimball, Inc.</i>
T. Y. SHEN	<i>Statistician, Federal Reserve Bank of Boston</i>
ALBERT SLAVIN	<i>Assoc. Prof. of Accounting, Northeastern University</i>
FRANK TURGEON	<i>Security Analyst, Keystone Custodian Funds, Inc.</i>
LESLIE E. WOODS	<i>Director of Personnel and Industrial Relations, Raytheon Company</i>

NORTHEASTERN UNIVERSITY

GENERAL INFORMATION

Northeastern University is incorporated as a philanthropic institution under the General Laws of Massachusetts. The State Legislature, by special enactment, has given the University general degree granting powers.

The Corporation of Northeastern University consists of men who occupy responsible positions in business and the professions. This Corporation elects from its membership a Board of Trustees in whom the control of the institution is vested. The Board of Trustees has four standing committees: (a) an Executive Committee which has general supervision of the financial and educational policies of the University; (b) a Committee on Buildings which has general supervision over the building needs of the University; (c) a Committee on Funds and Investments which has the responsibility of administering the funds of the University; (d) a Committee on Development which is concerned with furthering the development plans of the University.

Founded in 1898, Northeastern University, from its beginning, has had as its dominant purpose the discovery of human and social needs and the meeting of these needs in distinctive and highly serviceable ways. While subscribing to the most progressive educational thought and practice, the University has not duplicated the programs of other institutions but has sought "to bring education more directly into the service of human needs."

UNDERGRADUATE PROGRAMS

The College of Liberal Arts offers majors in the usual fields of the arts and sciences leading to the degrees of Bachelor of Arts and Bachelor of Science. With the exception of pre-professional programs, day curricula are normally five years in length and operated on the Co-operative Plan. However, in all majors except Chemistry and Physics, qualified students, with the approval of the Dean, may elect to complete the requirements for the degree on a full-time plan in four years.

The College of Liberal Arts offers certain of its courses during evening hours, constituting a program of three years' duration equivalent in hours to one-half the requirements for the A.B. or S.B. degree. The degree of Associate in Arts is conferred upon those who complete this program. A complete A.B. program is also offered in the evening division with curricula in Economics, History and Government, and Sociology.

The College of Education offers the option of study on the conventional four-year full-time plan or on the five-year Co-operative Plan. Both programs lead to the degree of Bachelor of Science in Education. These are designed particularly to meet the needs of high school graduates who desire to prepare themselves for teaching and administrative positions in elementary and secondary schools.

The College of Business Administration offers five-year co-operative curricula in Accounting, Business Management, Finance and Insurance, Industrial Relations, and Marketing and Advertising leading to the degree of Bachelor of Science in Business Administration.

The School of Business — operated during evening hours — offers undergraduate curricula leading to the degree of Bachelor of Business Administration in Accounting, Management, Law and Business, Engineering and Management, Liberal Arts and Business. For students who because of occupational reasons desire shorter programs concentrating in specific areas, Institutes awarding the certificate are offered in various fields.

The College of Engineering offers five-year co-operative curricula in Civil, Mechanical, Electrical, Chemical, and Industrial Engineering leading to the degree of Bachelor of Science with specification according to the department in which the student qualifies.

GRADUATE PROGRAMS

Graduate work was started for teaching fellows in 1940 and has since expanded into six departments.

In response to a need for evening work on the graduate level, course work in certain engineering areas was started in 1948. This program

developed rapidly, and at present evening programs leading to the Master of Science degree are given in seven engineering and science departments. A co-operative graduate program in engineering was started in 1956, and at present degrees from this plan of study are offered by four engineering departments.

The evening graduate work was expanded in 1951 by a program leading to the Master of Business Administration degree; in 1953 a similar program was initiated to allow students to earn a Master of Education degree in late-afternoon or evening classes.

The teaching fellow programs enable graduate students to further their academic training while they obtain valuable experience in teaching. The evening programs are designed for those who wish to carry on advanced study on a part-time basis while continuing their regular employment. In the co-operative programs students alternate work periods with study periods so that industrial experience can be obtained along with advanced academic training. The courses in all programs have been designed to give penetrating understanding of fundamentals as well as a breadth of knowledge in allied fields.

BUILDINGS AND FACILITIES

LOCATION

Northeastern University is located on Huntington Avenue in the Back Bay section of Boston. The main administrative offices of the University are located in Richards Hall.

The chief railroad centers of Boston are the North and South Stations. To reach the University from the North Station, board an MTA subway car going to Park Street and transfer there to any Huntington Avenue car. To reach the University from the South Station, board a Cambridge-bound subway train and transfer at Park Street to a Huntington Avenue car. The "Northeastern" station is the first stop outside the subway.

HUNTINGTON AVENUE CAMPUS

The principal educational buildings of Northeastern University are located on a sixteen-acre site in the Back Bay section of Boston. Only one block to the west of the University lie the famous Boston Museum of Fine Arts and the beautiful public gardens-park reservation known as "The Fenway."

Following a long-range development plan, University facilities have expanded substantially in recent years. In addition to the six buildings constructed within the last two decades, several modernized older buildings are available for specialized uses. The newer buildings on the campus are interconnected by means of tunnels, so that the students may go from building to building without going out of doors in inclement weather. All of the buildings are used in common by the students of the four colleges.

In addition to classrooms and instructional offices, the principal buildings include the following:

Botolph Building — Civil Engineering Laboratories

Cabot Physical Education Center — Gymnasium, Cage, Rifle Range

Dodge Library — Library, Drawing Rooms

Ell Student Center — Student Activities, Health Department, Chapel, Auditorium, and University Commons

Forsyth Building — Industrial and Mechanical Engineering Laboratories

Graduate Center — Administrative Offices of the Graduate School, Physics Laboratories, and Cafeteria.

Greenleaf Building — ROTC Headquarters, Research Facilities

Hayden Hall — Offices of the University College, Business, Education, and Electrical Engineering Laboratories, Art Studio

Richards Hall — Administrative Offices, Mechanical Engineering, Psychology and Chemistry Laboratories, Bookstore

Science Hall — Chemical Engineering and Biology Laboratories

Graduate School Regulations

GRADUATE SCHOOL REGULATIONS

ADMISSION

For admission to the Graduate Programs, applicants must have a bachelor's degree from an accredited program in the appropriate field. A personal interview with the Director of Graduate Business Administration Programs is required of all students wishing to enter any of the programs. A transcript of the applicant's prior college training should be presented at that time; if this is not possible, such material should be filed within six weeks after registration. No second registration will be allowed, nor will any grades of courses taken in the first registration period be issued until a transcript has been received and reviewed.

REGISTRATION

At the beginning of each semester, all students must register in the Graduate School office at the times indicated on the calendar.

Students in the evening part-time program, after a review of their transcripts, will be classified as regular or special.

Regular Students: Students who have a bachelor's degree from an accredited program with acceptable quality of undergraduate work are designated as Regular Students.

Special Students: Students whose undergraduate record is not acceptable for regular classification are designated as Special Students.

DEGREE CANDIDACY

Admission to a course or courses does not constitute acceptance as a candidate for a Master's degree.

A student who has achieved regular classification and who has completed twelve credits of required courses in the program with a grade of B or better, will be admitted to degree candidacy.

REQUIREMENTS FOR THE DEGREE OF MASTER OF BUSINESS ADMINISTRATION

Thirty semester hours of work are required for the degree of Master of Business Administration. The program of required and elective courses is given in a later section.

To make an effective total program, the selection of elective courses may be one of penetration and specialization in a given field, or it may be one cutting across related fields giving supporting breadth to the student's education. Department heads and the Director of the Graduate Business Administration Programs are readily available for counsel in the selection of electives. In every case, the student must be able to comply with the prerequisites or preparation requirements of his course selections.

In cases where additional evidence of qualification for graduate study would appear to be necessary, the applicant may be required to take the Admission Test for Graduate Study in Business, administered by the Educational Testing Service. The test is designed to measure aptitude for graduate study in business and is not a measure of knowledge in specific subjects. No special preparation is required. There is no passing or failing score on the test. The test is given at a local university and arrangements are made directly by the applicant with the Educational Testing Service.

STUDY LOAD

All graduate students are limited to a program of four semester hours of course work per semester unless granted special permission by the Director of Graduate Study in Business Administration to carry a heavier course load. Thus, those who carry two evenings a week (four semester hours of course work) continuously for both semesters, may complete the requirements of thirty semester hours for the degree within four years. Some students may find it possible to shorten this period to three years by enrolling in the Summer Sessions.

GRADING SYSTEM

The performance of students in graduate courses will be recorded by the instructor by use of the following grades:

A — Excellent

This grade is given to those students whose performance in the course has been of very high graduate caliber.

B — Satisfactory

This grade is given to those students whose performance in the course has been at the level necessary for graduate credit.

C — Fair

This grade is used to indicate that the student's performance in the course may be acceptable but is not consistently at the level expected in graduate work.

F — Failure

This grade is used to indicate unsatisfactory work.

In addition, the following letter designations are used:

E — Course registration canceled for nonattendance.

I — Incomplete, without quality designation. This is used when a student does not take the final examination or otherwise fails to complete the work of the course.

S — Satisfactory, without quality designation. This is used for thesis work.

W — Withdrawn without prejudice.

An average of not less than B must be obtained in thirty course credits in order to qualify for the master's degree. If a grade of F is obtained in a required course, the course must be repeated and a grade of B or better obtained. If a grade of F is obtained in an elective course, this course may either be repeated or another elective course substituted for it. In the case of a repeated elective course, a grade of B must be obtained. A maximum of thirty-four course credits may be undertaken in qualifying for the degree.

The designation "I" will be changed to a grade upon removal of the "I" provided deficiencies are made up by the end of the semester following the one in which the "I" was reported. If the course defi-

iciencies are not made up within the specified time, the grade of I will automatically become a grade of F. Missed final examinations cannot be made up without the approval of the Dean or Director of the program involved. Approval for such make-up is given only for emergency reasons and must be obtained within one month following the date of the missed examination.

WITHDRAWALS

No withdrawal from a course is allowed after the tenth class session. Any student who is absent from three class periods in succession without excuse is dropped from the class.

The University provides all instruction and accommodations on an academic semester basis; therefore, no refunds are granted except in cases where students are compelled to withdraw because of personal illness or other reasons beyond their control. A student must complete an official withdrawal application at the Graduate School office before being considered for a refund. In no case are refunds made after a student has attended the fifth session of a class. Questions regarding refunds should be discussed with the Bursar's office.

TIME LIMITATIONS

Course credits earned in the program of graduate study are valid for a maximum period of eight years. This time limitation is likewise applicable to any offered transfer credits.

TRANSFER OF CREDITS

Not more than eight semester hours of graduate credit may be transferred from other institutions towards the degree of Master of Business Administration at Northeastern University. Grades in courses offered for transfer must be B or higher. Acceptance of credits for transfer will not be approved until the student is admitted to candidacy, and then only if the work submitted for transfer credit is consonant with the objective of the approved program.

TUITION AND FEES

The policies governing the amount and the regulations pertaining to the payment of tuition and fees are established by the Executive Council of Northeastern University. The Council reserves the right to change these regulations at any time. Such changes will apply to students currently enrolled as well as new applicants for admission.

1. *Schedule of Tuition and Fees*

Registration Fee — payable at time of first registration	\$10.00
Tuition — per course	60.00
Late Payment Fee — for failure to pay tuition on specified date	2.00
Make-up Final Examination Fee	5.00
Graduation Fee — payable on or before May 1 of year in which student expects to graduate.....	20.00

2. *Payments*

Tuition statements will be mailed to the students by the Student Accounts office and are payable on or before the date specified. Checks should be drawn payable to "Northeastern University."

VETERANS

Veterans who expect to obtain educational benefits from the Veterans Administration should visit the Northeastern University Veterans office, Room 245, Richards Hall, prior to registration. The Veterans office at Northeastern University is operated by the University and is prepared to give any assistance the veterans may require in obtaining Veteran's benefits.

CLASS HOURS, INSTRUCTIONAL CALENDAR

During the first and second semesters each course meets one evening per week for two hours for sixteen weeks, including the final examinations. In the summer session each course meets twice a week for a period of eight weeks. For opening and closing dates of these sessions consult the Academic Calendar of this Bulletin.

INTERVIEW AND REGISTRATION DATES, OFFICE HOURS, AND CLASS SCHEDULES

For dates of the interview and registration periods and office hours consult the inside front cover. The registration circulars issued in August, January, and May provide information regarding class meeting times and teaching staff as well as listing the course offerings for the first semester, second semester, and summer session, respectively. Copies of these circulars may be obtained from the office of The Graduate School, Northeastern University, Boston 15, Massachusetts or by calling COpley 7-6600.

**Curricula
and
Course Descriptions**

The objective of the Graduate School of Business is to provide an opportunity for men and women to develop themselves for positions of responsibility in the business community. The faculty believes in the value of graduate study in business for employed students. Experience has shown that high standards of performance can be effectively maintained by such students whose backgrounds stimulate and promote interest, appreciation, and understanding of advanced courses of instruction.

Business Administration in a complex economy requires the interrelationship of many specialized areas. The function of the administrator is largely one of coordinating through effective policy the contributions of many specialized skills.

In developing the graduate program, the Committee on Curriculum and Standards has incorporated the thoughts expressed by successful business executives as to what is most effective in the development of those who assume managerial responsibilities. To accomplish these objectives, the faculty is composed of men of professional competence who have had extensive experience in business and industry, in addition to their academic training.

In contrast to narrow specialization in a specific area, the graduate program offered in the Graduate School aims at scope or breadth of

understanding. The required courses cut across the several major areas of operation with which the executive must deal on the policy level, including advanced consideration of the varied problems in organization, production, distribution, finance, labor relations, etc. Through the required and elective courses the student is provided an opportunity to pursue his major interest as well as secure an understanding of the forces influencing our economy.

The descriptions of courses offered by the several departments are given so that prospective students may obtain a view of the course coverage. Preparation courses are indicated in each instance. Not all courses are offered every year but the course offerings will be arranged in such a manner that students may make continuous progress toward the degree.

The number of students enrolled in each class will be limited to permit effective teaching at the graduate level and the University reserves the right to cancel any course for which an insufficient number of students apply.

One semester hour credit is awarded for the work represented by a class meeting for one hour each week for one regular sixteen-week semester.

TEACHING FELLOW PROGRAM

CURRICULUM — MASTER OF BUSINESS ADMINISTRATION

A limited number of people are accepted each year as teaching fellows in the Accounting Department of the College of Business Administration. The admission requirements are a B.S. degree in Business Administration from an accredited institution. Thirty semester hours of work are required including a thesis to the extent of six semester hours. This program normally takes two years, and the sequence of courses is arranged after consultation with the Director of Graduate Business Administration Programs.

EVENING PART-TIME PROGRAM

CURRICULUM — MASTER OF BUSINESS ADMINISTRATION

Applicants who are deficient in accounting, economics, industrial technology, mathematics or statistics will be required to take credit-carrying foundation courses in these topics offered by the Graduate School.

Such requirements will be prescribed by the Director of Graduate Business Administration Programs when the transcript of undergraduate work has been reviewed.

In addition to any needed foundation courses, each student must take twenty semester hour credits of required courses as described in Area II and ten semester hour credits of elective courses as described in Area III.

DESCRIPTION OF COURSES

AREA I — FOUNDATION COURSES

The following courses are given for graduate credit to remedy preparatory deficiencies and to enable all students to proceed on more equal footing toward the M.B.A. degree, which requires 30 additional credit hours.

14.151 Mathematics for Business Administration I

(Offered yearly, 1st sem.)

Prerequisite: The equivalent of one year of college algebra

Course Content: An introduction to some of the modern concepts of mathematics such as linear programming, theory of games, probability, vectors and

matrices. While primarily a mathematics course, applications will be made to Business Administration and the social sciences, particularly economics.

14.152 Mathematics for Business Administration II

(Offered yearly, 2nd sem.)

Prerequisite: 14.151 Mathematics for Business Administration I

Course Content: A continuation of 14.151 I Mathematics for Business Administration

20.101 Statistical Analysis (Offered yearly, 1st and 2nd sem.)

Course Content: This course is devoted to a general survey of quantitative methods in business and economics. Topics include the principles and application of correlation, regression, time series analysis, and index numbers.

20.103 Managerial Economics I (Offered yearly, 1st sem.)

Course Content: Macro-economic analysis, the structure of national income accounts; underlying determinants of aggregate economic activity; recent theoretical models of disequilibrium, growth and fluctuations; employment and wage levels.

20.104 Managerial Economics II (Offered yearly, 2nd sem.)

Prerequisite: 20.103 Managerial Economics I

Course Content: Micro-economic analysis, approaches to a theory of demand; cost behavior in the individual firm; programming the capital budget; implications of varying market structures for price-output relationships.

20.107 Money, Finance, and Fiscal Policy (Offered Summer, 1960)

Course Content: Monetary theory related to theories of finance; the importance and behavior of money in the financial sector of total economic activity; empirical findings in this area with evaluations of monetary and fiscal policy.

41.101 Managerial Accounting (Offered yearly, 1st and 2nd sem.)

Course Content: This course is designed to acquaint the student with the interrelationship of accounting, controlling, and reporting for the industrial and commercial enterprise. Greater emphasis is placed upon the result of general and corporate accounting procedures rather than the procedures themselves.

The origin and background of financial statements and budgets are considered to develop a better understanding of management's search into the qualitative aspect of accounting with respect to the management process.

45.103 Industrial Technology (Offered yearly, 1st and 2nd sem.)

Course Content: Subjects treated include product engineering and design, production planning and control, time and motion study, certain aspects of wage and salary administration, design of manufacturing processes and plant location and layout. Emphasis will be placed on the problems involved in administration of these activities.

The course makes use of technical notes, case problems, and text material to provide the student with basic knowledge and tools available for reaching administrative decisions on technological aspects of industrial problems.

AREA II — REQUIRED COURSES

The following courses are required of all students who wish to complete the requirements for the Master of Business Administration degree.

41.234 Control (Offered yearly, 1st and 2nd sem.)

Course Content: An indispensable tool for better managerial control is the establishment and operation of budgets. Requisites to successful budgeting and essential steps in budgetary control with the procedures for carrying out budget policies will be studied. Controllorship — the accounting and statistical function of business — is concerned with the responsibility of providing “fact-finding” information for top management in decision making. The work of the controller in obtaining and organizing the necessary data for managerial utilization will be an essential part of the course.

43.213 Marketing I (Offered yearly, 1st sem.)

Course Content: The objectives of this course are two-fold: to provide the student with a broad but comprehensive understanding of basic marketing functions, institutions, and policies, and to develop the students’ ability to recognize and deal with marketing problems. Particular attention is placed on defining the role of marketing in the economy as well as in the business firm. The course requires that marketing situations be examined from the marketing practitioner’s point of view involving analysis, decision, and programs of action. Sections of the course cover the consumer, both ultimate and industrial, product policy, channels of distribution, and pricing. Attention is also given to advertising, personal selling, marketing research, and integrated sales programs.

43.214 Marketing II (Offered yearly, 2nd sem.)

Prerequisite: 43.213 Marketing I

Course Content: Continuation of 43.213 Marketing I

44.209 Finance I (Offered yearly, 1st sem.)

Course Content: A study of the methods of selection and development of the optimum financial structure for the business firm, including financial activation of the organization and efficient maintenance of its operation; sources of initial as well as of operating capital; dividend policy and dividend payment procedure; organization for finance, including capital budgeting, tax planning, long-range fiscal planning; financing for reorganization, merger, and liquidation; international aspects of financial control; analysis of financial statements and the significance of operating ratios.

44.210 Finance II (Offered yearly, 2nd sem.)

Prerequisite: 44.209 Finance I

Course Content: A continuation of 44.209 Finance I.

45.206 Administrative Processes (Offered yearly, 1st and 2nd sem.)

Prerequisites: 44.209, 44.210 Finance I and II

45.211, 45.212 Production I and II

43.213, 43.214 Marketing I and II

Course Content: This course is concerned, at the top management level, with the problems involved in the organizational and structural processes related to administrative and organizational operation. It presents an integrated approach to the policy and planning function as it cuts across departmental lines of control. Advantages and disadvantages of various types of organization are explored and discussed in terms of optimum values involved.

45.211 Production I (Offered yearly, 1st sem.)

Course Content: Top management consideration of the responsibilities and function in organizing for, planning, and controlling the procedures of production. The course considers the modern tendencies of industrial development, specifically integration, concentration, consolidation, specialization, standardization, and diversification. It includes a study of the consumptive demand to determine markets and what to manufacture; factors affecting the industrial site, such as accessibility to raw materials, adequate labor supply, transportation service and costs; plan and design, construction and layout for effective production flow; selection of equipment; the coordination of output with demand; seasonal production; production planning; inventory control; quality control; procurement; cost control; methods of compensation of labor.

45.212 Production II (Offered yearly, 2nd sem.)

Prerequisite: 45.211 Production I

Course Content: A continuation of 45.211 Production I.

45.231 Human Relations in Business Organizations I

(Offered yearly, 1st sem.)

Course Content: The basic purpose is to give the student an opportunity to develop a way of thinking about human behavior in organizations that will enable him to play an effective administrative role.

The usual setting for administrative activity includes powerful social and psychological forces governing behavior. Administrators must think clearly in the face of changing situations in which they are involved both as individuals with personal needs and as major determinants of the satisfaction of others.

Classroom and written work focuses on the analysis and discussion of concrete case situations describing the behavior of individuals and groups in

various work settings. The case work is supplemented by readings that introduce the student to concepts developed by researchers, teachers and practitioners in the field of business administration with respect to human relations in industry.

45.232 Human Relations in Business Organizations II
(Offered yearly, 2nd sem.)

Prerequisite: 45.231 Human Relations in Business Organizations I

Course Content: A continuation of 45.231 Human Relations in Business Organizations I with emphasis on analysis of individual behavior. The objective is to give the student an opportunity to improve his skill in understanding others as well as his ability to communicate.

AREA III — ELECTIVE COURSES

Each student must take ten semester hour credits from the following courses with a maximum of six from any single functional elective group.

A — FUNCTIONAL ELECTIVES

Finance

44.212 Investment Management (Offered yearly, 2nd sem.)

Course Content: This course reviews investment objectives and discusses various methods of building an investment portfolio to achieve given objectives.

Emphasis will be placed on those aspects of security market operation which will be useful to the businessman and which will furnish background for those who may be interested in the brokerage business.

Production

45.203 Manufacturing Management (Offered yearly, 1st and 2nd sem.)

Course Content: This case discussion course approaches the problems of manufacturing operations as experienced on the plant manager level. Reflecting the various elements involved in production planning and control, it is concerned with the economics of production when considering the aspects of specialization, simplification, standardization, and diversification as well as expansion, contraction, or integration. It includes such factors of production as materials, plant location and layout, power, maintenance, labor supply, organization, wage policy, etc., and concludes with cases considering the controls of the manufacturing processes, i.e., product development, scheduling, inventory, quality, cost, and budgetary controls.

Marketing

43.241 Advertising Management (Offered yearly, 1st sem.)

Prerequisite: 43.214 Marketing II

Course Content: This course deals primarily with the formulation of advertising policy and programs from a top management point of view. Emphasis is placed on determining the "mix" of marketing elements, with emphasis on advertising, that satisfies the particular situations of various businesses. The objective of the course is not to train advertising technicians; rather, it is to give a view point and training to those who may be required to formulate, administer, or evaluate advertising and marketing programs. Course work consists of readings, text material, and case discussions. Both industrial and consumer goods advertising are covered.

43.205 Marketing Management (Offered yearly, 1st and 2nd sem.)

Course Content: Based upon a management point of view, this course is decision-oriented and analytical. It sets forth a definite way of looking at current developments in marketing management and marketing practice. Recent developments in the behavioral sciences, mainly economics, psychology, and sociology, are related to responsibilities of marketing management.

43.242 Marketing Research (Offered yearly, 2nd sem.)

Course Content: The art of scientific investigation is applied to typical marketing problems such as product research, advertising and sales control. A step-by-step procedure for defining a problem and carrying out the research necessary for its solution is developed. Special emphasis is given to motivation research and operations research techniques developed by social scientists and mathematicians for the solution of marketing problems.

Human Relations

43.215 Industrial Relations (Offered yearly, 1st and 2nd sem.)

Course Content: A study of managerial practice and policy relative to the recognition and solution of problems pertaining to employer-employee relations in industry; effective handling of controversial questions between management and the union, including contract negotiation, grievance procedure, and arbitration; communication between management, the union, and the rank and file; wage policies, including job evaluation, incentives, income security benefit plans, and labor costs; labor productivity; the problems of government controls in industrial relations; and the responsibilities of management and labor in a modern economy.

B — GENERAL ELECTIVE GROUP

43.202 Case Studies in Business Enterprise (Offered yearly, 1st sem.)

Course Content: A survey of the history of industrial endeavor and business

activity from its rudimentary stages to the present day, with careful attention to the evolution of business management, being successful and unsuccessful examples by case history; discussion of the role that business plays in shaping our economy and society as well as the effect of our social and economic order upon the business firm; special emphasis is given to the control of business by the state, monetary policies, public finance, the rise of banks, corporation commodity and stock exchanges, and their regulation and control.

20.204 Government and Business (Offered yearly, 1st sem.)

Course Content: The expanding scope of the government's economic and social activities is bringing about a much closer relationship between government and business. The course analyzes the role of government as a regulating force as well as the nature and impact of governmental fiscal, economic, and social policies upon the conduct of business. The political and economic philosophies behind greater government participation in the economic structure of the nation, as indicated by public utility, anti-trust, and labor and social legislation; the responsibilities accruing to government as the result of its participation in the regulation and shaping of our economic endeavor, i.e. high level production, stabilized employment and worker's income, housing, foreign policy, and industrial mobilization. Case studies and analyses of the legislative framework within which government participation in the economic structure is set make up the background of the course.

20.206 Economic Development (Offered yearly, 2nd sem.)

Course Content: This course deals with the enumeration, delineation and assessment of variables which determine the level and the nature of economic activity.

An introductory discussion of the economic factor in civilization is followed by an examination of the psychological, social and political influences on economic change. The role of various economic institutions in secular development is analyzed.

20.208 International Economic Relations (Offered yearly, 2nd sem.)

Course Content: The course will deal with two major areas: the rudiments of international economics and a survey of current problems in international relations. The topics in the first area include: theory of international trade, balance of payment problems; tariff policy and multilateral trade; capital movements. The topics in the second area include: problems of industrialized countries versus undeveloped countries; institutions of international economic cooperation such as International Monetary Fund, World Bank, and Common Markets. Not recommended for those who have had a good course in international trade.

45.208 Management of Small Enterprises (Offered yearly, 2nd sem.)

Course Content: Analysis of all phases of operation of a small business.

including selection of field of product, organizing, financing and setting up a small business, sales strategy. Profit operations, cash flows, cost controls, and profit planning primarily through discussion of small business organization cases.

C — ELECTIVES FROM OTHER PROGRAMS

Selected courses given in Engineering Management and in the Arts and Science Programs by the Economics Department are also available as electives. Such courses are given in the circular which is issued for each semester.

46.211 Business Cycles and Forecasting (Offered yearly, 1st sem.)

Course Content: The major business cycle theories are introduced together with a survey of the statistical history of fluctuations in business activity with particular reference to capitalism in the United States. Heavy emphasis on the techniques and weaknesses of forecasting; its importance to the economy, specific industries, and the individual firm.

46.101 Business Law I (Offered yearly, 1st sem.)

Course Content: A concentrated graduate-level review of the basic elements of business law. It is designed to acquaint the student with the vocabulary and the principles of law which have a major impact on managerial decisions. This course will not provide a basis for applying principles of law to business problems but should stimulate the student to further study and make him cognizant of the need for counsel when legal problems arise.

46.102 Business Law II (Offered yearly, 2nd sem.)

Prerequisite: 46.101 Business Law I

Course Content: A continuation of 46.101 Business Law I.

GIFTS AND BEQUESTS

Northeastern University will welcome gifts and bequests for the following purposes:

- (a) For its building program.
- (b) For general endowment.
- (c) For specific purposes which may especially appeal to the donor.

It is suggested that, when possible, those contemplating gifts or bequests confer with the President of the University regarding the University's needs before legal papers are drawn.

The legal name of the University is "Northeastern University." However, in the making of gifts and bequests to Northeastern, the following wording is suggested: "Northeastern University, an educational institution incorporated under the laws of Massachusetts and located in Boston, Massachusetts."

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NORTHEASTERN UNIVERSITY
GRADUATE SCHOOL

PROGRAMS IN
ENGINEERING

CATALOGUE 1960-1961



BOSTON 15, MASSACHUSETTS

APRIL 1960

Interview Periods and Regular Sessions

1960 SUMMER SESSION

Interview Period	May 23-June 2
Registration Period	May 23-June 2
Regular Session	June 6-July 2

1960-61 FIRST SEMESTER

Interview Period	Aug. 22-Sept. 1
Registration Period	Aug. 22-Sept. 1
Regular Session	Sept. 12-Jan. 2

1960-61 SECOND SEMESTER

Interview Period	Jan. 9-Jan. 2
Registration Period	Jan. 9-Jan. 2
Regular Session	Jan. 30-May 2

1961 SUMMER SESSION

Interview Period	May 22-June 2
Registration Period	May 22-June 2
Regular Session	June 5-July 2

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Monday through Friday	8:45 a.m.- 5:00 p.m.
Saturday	8:45 a.m.-12:00 noon

SPECIAL OFFICE HOURS DURING REGISTRATION PERIODS ONLY

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Saturday	9:00 a.m.-12:00 noon

The office is closed on all legal holidays.

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GRADUATE SCHOOL

PROGRAMS IN
ENGINEERING

CATALOGUE 1960-1961



LEADING TO THE DEGREE OF MASTER OF SCIENCE

BOSTON 15, MASSACHUSETTS

APRIL 1960

GRADUATE PROGRAMS

AT

NORTHEASTERN UNIVERSITY



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ACADEMIC CALENDAR

MAY 1960 - JUNE 1961

SUMMER SESSION 1960

Interview and Registration Period	Monday-Saturday	May 23-June 4
Memorial Day, Office Closed	Monday	May 30
Classes Begin	Monday	June 6
Independence Day, No Classes	Monday	July 4
Classes End	Tuesday	July 26
Examination Period	Wednesday-Thursday	July 27-July 28

FIRST SEMESTER 1960-1961

Interview and Registration Period	Monday-Saturday	Aug. 22-Sept. 1
Labor Day, Office Closed	Monday	Sept. 5
Classes Begin	Monday	Sept. 12
Columbus Day, No Classes	Wednesday	Oct. 12
Veterans' Day, No Classes	Friday	Nov. 11
Thanksgiving Vacation	One Week	Nov. 21-Nov. 22
Classes Resume	Monday	Nov. 28
Christmas Vacation	Two Weeks	Dec. 20-Jan. 2
Classes Resume	Tuesday	Jan. 3
Classes End	Friday	Jan. 13
Examination Period	Monday-Friday	Jan. 16-Jan. 20
No Classes	Monday-Friday	Jan. 23-Jan. 27

SECOND SEMESTER 1960-1961

Interview and Registration Period	Monday-Saturday	Jan. 9-Jan. 28
Classes Begin	Monday	Jan. 30
Washington's Birthday, No Classes	Wednesday	Feb. 22
Patriots' Day, No Classes	Wednesday	April 19
Classes End	Friday	May 12
Make-up for Classes Missed Wed., April 19	Wednesday	May 17
Examination Period	Monday-Friday	May 22-May 28

CALENDAR

APRIL 1, 1960 - JUNE 30, 1961

1960

APRIL							MAY							JUNE						
S	M	T	W	T	F	S	S	M	T	W	T	F	S	S	M	T	W	T	F	S
					1	2	1	2	3	4	5	6	7			1	2	3	4	
3	4	5	6	7	8	9	8	9	10	11	12	13	14	5	6	7	8	9	10	11
0	11	12	13	14	15	16	15	16	17	18	19	20	21	12	13	14	15	16	17	18
7	18	19	20	21	22	23	22	23	24	25	26	27	28	19	20	21	22	23	24	25
4	25	26	27	28	29	30	29	30	31					26	27	28	29	30		

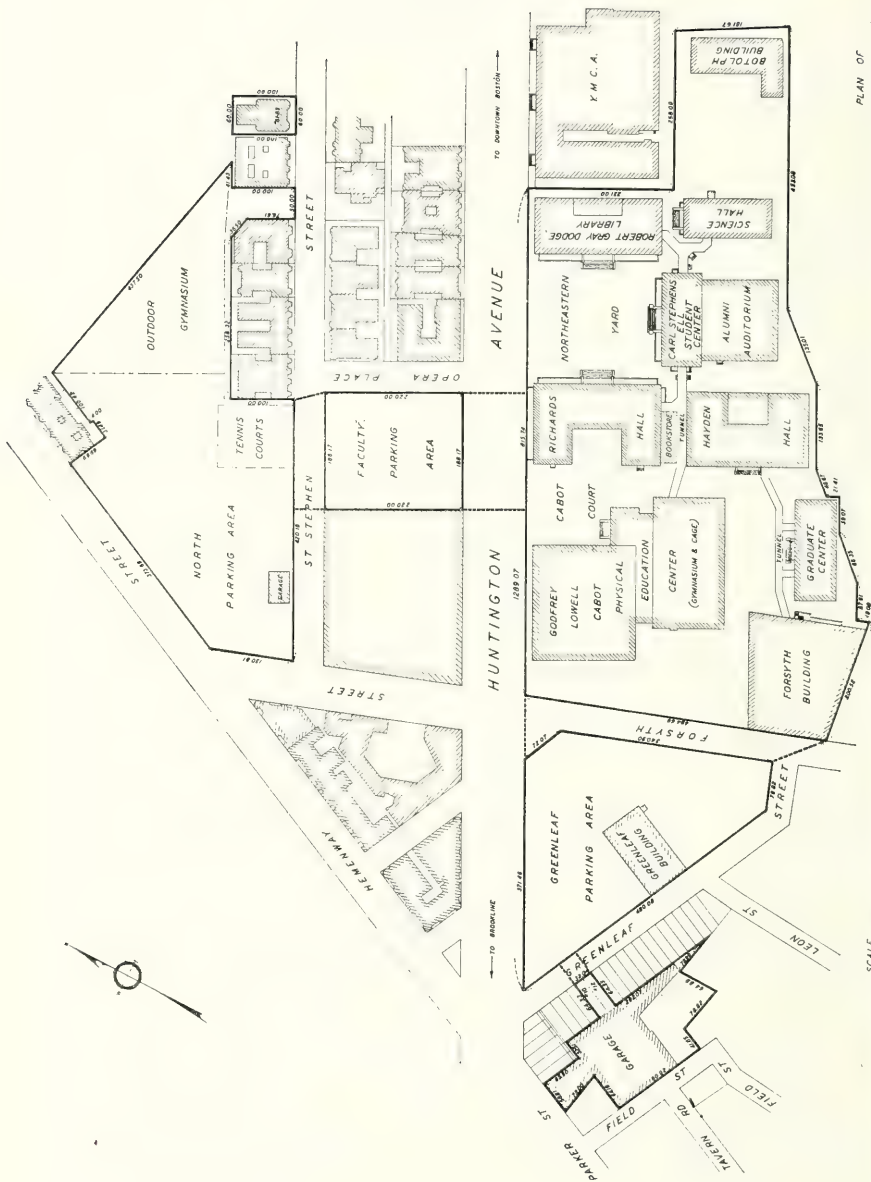
JULY							AUGUST							SEPTEMBER							
S	M	T	W	T	F	S	S	M	T	W	T	F	S	S	M	T	W	T	F	S	
					1	2		1	2	3	4	5	6						1	2	3
3	4	5	6	7	8	9	7	8	9	10	11	12	13	4	5	6	7	8	9	10	
0	11	12	13	14	15	16	14	15	16	17	18	19	20	11	12	13	14	15	16	17	
7	18	19	20	21	22	23	21	22	23	24	25	26	27	18	19	20	21	22	23	24	
4	25	26	27	28	29	30	28	29	30	31				25	26	27	28	29	30		
1																					

OCTOBER							NOVEMBER							DECEMBER							
S	M	T	W	T	F	S	S	M	T	W	T	F	S	S	M	T	W	T	F	S	
						1			1	2	3	4	5						1	2	3
2	3	4	5	6	7	8	6	7	8	9	10	11	12	4	5	6	7	8	9	10	
9	10	11	12	13	14	15	13	14	15	16	17	18	19	11	12	13	14	15	16	17	
6	17	18	19	20	21	22	20	21	22	23	24	25	26	18	19	20	21	22	23	24	
3	24	25	26	27	28	29	27	28	29	30				25	26	27	28	29	30	31	
0	31																				

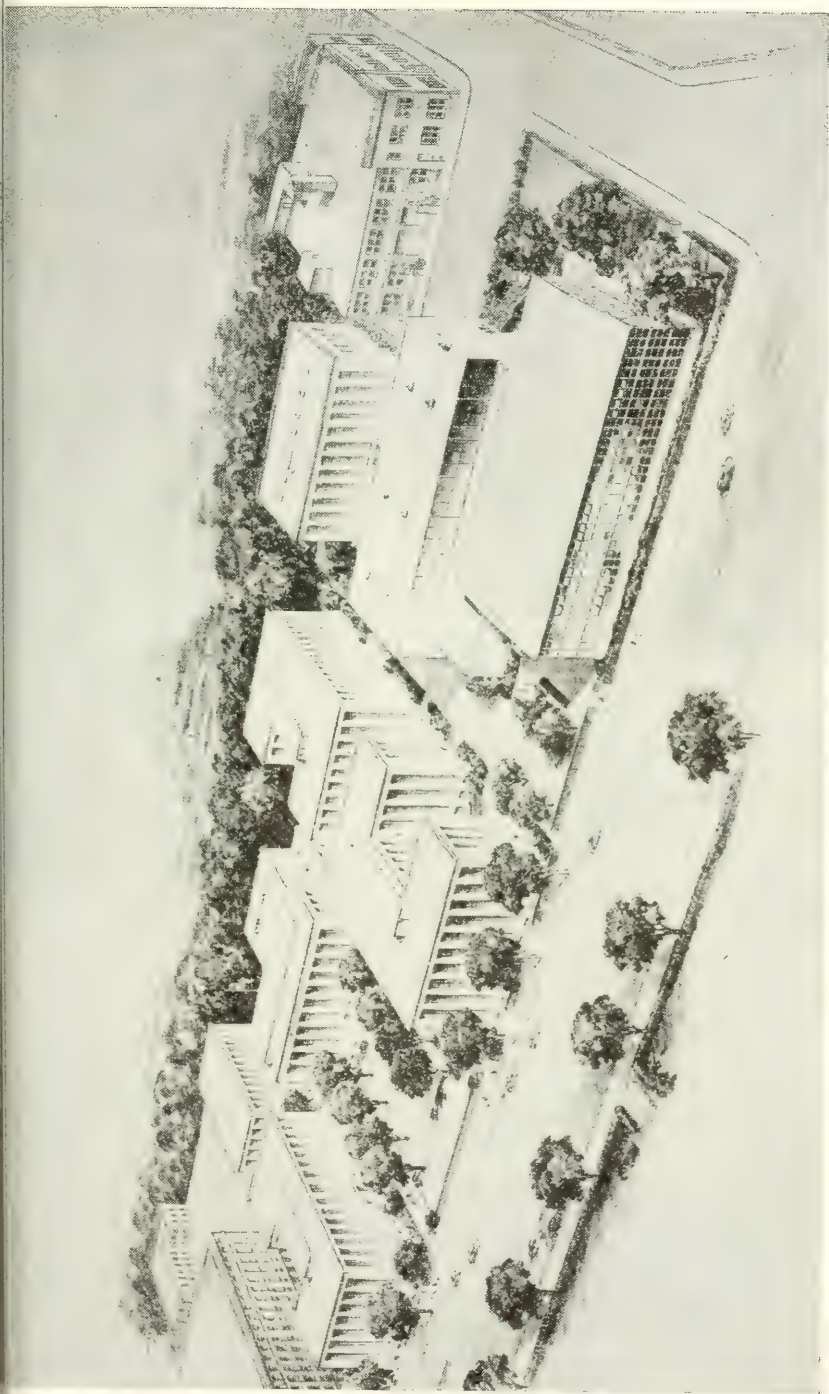
1961

JANUARY							FEBRUARY							MARCH						
S	M	T	W	T	F	S	S	M	T	W	T	F	S	S	M	T	W	T	F	S
1	2	3	4	5	6	7			1	2	3	4				1	2	3	4	
3	9	10	11	12	13	14	5	6	7	8	9	10	11	5	6	7	8	9	10	11
5	16	17	18	19	20	21	12	13	14	15	16	17	18	12	13	14	15	16	17	18
2	23	24	25	26	27	28	19	20	21	22	23	24	25	19	20	21	22	23	24	25
7	30	31					26	27	28					26	27	28	29	30	31	

APRIL							MAY							JUNE								
M	T	W	T	F	S		S	M	T	W	T	F	S		S	M	T	W	T	F	S	
					1			1	2	3	4	5	6							1	2	3
2	3	4	5	6	7	8	7	8	9	10	11	12	13		4	5	6	7	8	9	10	
9	10	11	12	13	14	15	14	15	16	17	18	19	20		11	12	13	14	15	16	17	
16	17	18	19	20	21	22	21	22	23	24	25	26	27		18	19	20	21	22	23	24	
23	24	25	26	27	28	29	28	29	30	31					25	26	27	28	29	30		



SCALE
0 50 100 150 200 250



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The teaching staff of the Graduate Engineering Programs is composed of regular full-time faculty members of Northeastern University, members of the faculties of neighboring institutions, and private engineers. The composition of the teaching staff during any particular school year is dependent upon the courses offered during that year. The teaching staff of the Graduate Engineering Programs includes the following:

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ROMEO L. ALTMAN	<i>Senior Engineer, Laboratory for Electronics</i>
ETH A. ARMEN	<i>Asst. Professor of Accounting, Northeastern University</i>
ALPH E. BACH, JR.	<i>Asst. Prof. of Research in Comm., Northeastern University</i>
LAN D. BAILEY	<i>Research Associate, Northeastern University</i>
ONEY D. BLACK	<i>Supervisor, Electro-Mech. Devel., Thomson Lab., General Electric Co.</i>
ALPH S. BLANCHARD, JR.	<i>Asst. Prof. of Mech. Eng., Northeastern University</i>
GEORGE G. BOGREN	<i>Partner, Weston and Sampson</i>
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WARD M. COOK	<i>Assoc. Prof. of Mathematics, Northeastern University</i>
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HERBERT L. GROGINSKY	<i>Staff Engineer, Raytheon Company</i>
JAMES F. HALEY	<i>Consulting Soil Engineer, Haley and Aldrich</i>
FRANK E. HEART	<i>Computer Engineer, Lincoln Lab., Mass. Inst. of Technology</i>
DAVID J. HERDER	<i>Adv. Development Engineer, General Electric Company</i>
ALBERT E. HICKEY, JR.	<i>Manager, Human Factors Dept., Itek Corporation</i>
DAVID E. HIGGINBOTHAM	<i>Assoc. Prof. of Elect. Eng., Tufts University</i>
ARTHUR E. KEATING	<i>Prof. of Industrial Eng., Northeastern University</i>
NICHOLAS P. KERNWEIS	<i>Asst. Prof. of Elect. Eng., Northeastern University</i>
PETER S. KING	<i>Asst. Prof. of Marketing, Mass. Inst. of Technology</i>
JOHN J. KLEIN	<i>Sr. Member, Tech. Staff, Airborne Systems Lab., R.C.A.</i>
ROBERT S. KLEINSCHMIDT	<i>Asst. Prof. of Civil Engineering, Northeastern University</i>
ROBERT C. KUHN	<i>Plant Accountant, General Electric Company</i>
EARLE R. LASTE	<i>Instructor in Elect. Eng., Northeastern University</i>
JOSEPH H. LENNEY	<i>Asst. Prof. of Civil Eng., Northeastern University</i>
PASCAL LEVESQUE	<i>Chief of Metallurgical Research, Raytheon Company</i>
WALTER H. LOB	<i>Assoc. Prof. of Research in Comm. Northeastern University</i>
MORTON LOEWENTHAL	<i>Staff Member, Lincoln Lab., Mass. Inst. of Technology</i>
BERTRAM S. LONG	<i>Asst. Prof. of Mech. Eng., Northeastern University</i>

HN E. MARSHALL	<i>Prof. of Mgmt. Division, Babson Institute, and Management Consultant</i>
OBERT N. MARTIN	<i>Instructor in Elect. Eng., Northeastern University</i>
OWARD MASKALENKO	<i>Assoc. Prof. of Elect. Eng., Tufts University</i>
AROLD K. MCAFEE	<i>Engineer, Fay, Spofford & Thorndike, Inc.</i>
ILLIAM M. MURRAY	<i>Prof. of Mech. Eng., Mass. Inst. of Technology</i>
ICHARD J. NICKERSON	<i>Asst. Prof. of Mech. Eng., Mass. Inst. of Technology</i>
SEPH A. NORDSTROM	<i>Assoc. Prof. of Industrial Eng., Northeastern University</i>
EPHEN J. O'NEIL	<i>President, Systems Engineering, Inc.</i>
HOMAS E. PHALEN, JR.	<i>Asst. Prof. of Mech. Eng., Northeastern University</i>
SPENCER ROCHEFORT	<i>Assoc. Prof. of Research in Comm., Northeastern University</i>
ARNET L. ROSENTHAL	<i>Chief of Laboratory, Mass. Dept. of Public Health</i>
STEPHEN SCHLOSS	<i>Instructor in Mathematics, Northeastern University</i>
ONALD E. SCOTT	<i>Prof. of Elect. Eng., Northeastern University</i>
ENRY SIMON	<i>Technical Staff, Bell Telephone Laboratories</i>
HOMAS C. STOCKEBRAND	<i>Staff Engineer, Lincoln Lab., Mass. Inst. of Technology</i>
ALPH A. TROUPE	<i>Research Prof. of Chem. Eng., Northeastern University</i>
ENTARO TSUTSUMI	<i>Principal Engineer, Jackson and Moreland, Inc.</i>
LEXANDER VANDERBURGH, JR.	<i>Staff Member, Lincoln Lab., Mass. Inst. of Technology</i>
HN H. WELLS	<i>Principal Engineer, Structural, Jackson and Moreland, Inc.</i>
OBERT B. WILCOX	<i>Project Mgr., Missile Sys. Lab., Sylvania Waltham Labs.</i>
ARTHUR W. WINSTON	<i>Senior Physicist, Physics Dept. National Research Corp.</i>
VIN J. YORRA	<i>Asst. Prof. of Mech. Eng., Northeastern University</i>
HN ZOTOS	<i>Metallurgist, Rodman Lab., Watertown Arsenal</i>

NORTHEASTERN UNIVERSITY

GENERAL INFORMATION

Northeastern University is incorporated as a philanthropic institution under the General Laws of Massachusetts. The State Legislature by special enactment, has given the University general degree granting powers.

The Corporation of Northeastern University consists of men who occupy responsible positions in business and the professions. The Corporation elects from its membership a Board of Trustees in whom the control of the institution is vested. The Board of Trustees has four standing committees: (a) an Executive Committee which has general supervision of the financial and educational policies of the University; (b) a Committee on Buildings which has general supervision over the building needs of the University; (c) a Committee on Funds and Investments which has the responsibility of administering the funds of the University; (d) a Committee on Development which is concerned with furthering the development plans of the University.

Founded in 1898, Northeastern University, from its beginning, has had as its dominant purpose the discovery of human and social needs and the meeting of these needs in distinctive and highly serviceable ways. While subscribing to the most progressive educational thought and practice, the University has not duplicated the programs of other institutions but has sought "to bring education more directly into the service of human needs."

UNDERGRADUATE PROGRAMS

The College of Liberal Arts offers majors in the usual fields of the arts and sciences leading to the degrees of Bachelor of Arts and Bachelor of Science. With the exception of pre-professional programs, day curricula are normally five years in length and operated on the Co-operative Plan. However, in all majors except Chemistry and Physics, qualified students, with the approval of the Dean, may elect to complete the requirements for the degree on a full-time plan in four years.

The College of Liberal Arts offers certain of its courses during evening hours, constituting a program of three years' duration equivalent in hours to one-half the requirements for the A.B. or S.B. degree. The degree of Associate in Arts is conferred upon those who complete this program. A complete A.B. program is also offered in the evening division with curricula in Economics, History and Government, and Sociology.

The College of Education offers the option of study on the conventional four-year full-time plan or on the five-year Co-operative Plan. Both programs lead to the degree of Bachelor of Science in Education. These are designed particularly to meet the needs of high school graduates who desire to prepare themselves for teaching and administrative positions in elementary and secondary schools.

The College of Business Administration offers five-year co-operative curricula in Accounting, Business Management, Finance and Insurance, Industrial Relations, and Marketing and Advertising leading to the degree of Bachelor of Science in Business Administration.

The School of Business — operated during evening hours — offers undergraduate curricula leading to the degree of Bachelor of Business Administration in Accounting, Management, Law and Business, Engineering and Management, Liberal Arts and Business. For students who because of occupational reasons desire shorter programs concentrating in specific areas, Institutes awarding the certificate are offered in various fields.

The College of Engineering offers five-year co-operative curricula in Civil, Mechanical, Electrical, Chemical, and Industrial Engineering leading to the degree of Bachelor of Science with specification according to the department in which the student qualifies.

GRADUATE PROGRAMS

Graduate work was started for teaching fellows in 1940 and has since expanded into six departments.

In response to a need for evening work on the graduate level, course work in certain engineering areas was started in 1948. This program

developed rapidly, and at present evening programs leading to the Master of Science degree are given in seven engineering and science departments. A co-operative graduate program in engineering was started in 1956, and at present degrees from this plan of study are offered by four engineering departments.

The evening graduate work was expanded in 1951 by a program leading to the Master of Business Administration degree; in 1953 a similar program was initiated to allow students to earn a Master of Education degree in late-afternoon or evening classes.

The teaching fellow programs enable graduate students to further their academic training while they obtain valuable experience in teaching. The evening programs are designed for those who wish to carry on advanced study on a part-time basis while continuing their regular employment. In the co-operative programs students alternate work periods with study periods so that industrial experience can be obtained along with advanced academic training. The courses in all programs have been designed to give penetrating understanding of fundamentals as well as a breadth of knowledge in allied fields.

BUILDINGS AND FACILITIES

LOCATION

Northeastern University is located on Huntington Avenue in the Back Bay section of Boston. The main administrative offices of the University are located in Richards Hall.

The chief railroad centers of Boston are the North and South Stations. To reach the University from the North Station, board an MTA subway car going to Park Street and transfer there to any Huntington Avenue car. To reach the University from the South Station, board a Cambridge-bound subway train and transfer at Park Street to a Huntington Avenue car. The "Northeastern" station is the first stop outside the subway.

HUNTINGTON AVENUE CAMPUS

The principal educational buildings of Northeastern University are located on a sixteen-acre site in the Back Bay section of Boston. Only one block to the west of the University lie the famous Boston Museum of Fine Arts and the beautiful public gardens-park reservation known as "The Fenway."

Following a long-range development plan, University facilities have expanded substantially in recent years. In addition to the six buildings constructed within the last two decades, several modernized older buildings are available for specialized uses. The newer buildings on the campus are interconnected by means of tunnels, so that the students may go from building to building without going out of doors in inclement weather. All of the buildings are used in common by the students of the four colleges.

In addition to classrooms and instructional offices, the principal buildings include the following:

- Botolph Building* — Civil Engineering Laboratories
- Cabot Physical Education Center* — Gymnasium, Cage, Rifle Range
- Dodge Library* — Library, Drawing Rooms
- Ell Student Center* — Student Activities, Health Department, Chapel, Auditorium, and University Commons
- Forsyth Building* — Industrial and Mechanical Engineering Laboratories
- Graduate Center* — Administrative Offices of the Graduate School, Physics Laboratories, and Cafeteria.
- Greenleaf Building* — ROTC Headquarters, Research Facilities
- Hayden Hall* — Offices of the University College, Business, Education, and Electrical Engineering Laboratories, Art Studio
- Richards Hall* — Administrative Offices, Mechanical Engineering, Psychology and Chemistry Laboratories, Bookstore
- Science Hall* — Chemical Engineering and Biology Laboratories

Graduate School Regulations

GRADUATE SCHOOL REGULATIONS

CO-OPERATIVE PLAN IN ENGINEERING

ADMISSION

A limited number of graduate students are enrolled in the Co-operative Graduate Program, in which alternate periods of work and study are carried on. Two years are needed for completion of the requirements for the degree under this program.

Applicants should have a degree in the appropriate engineering field, and their undergraduate record must show an ability to profit from graduate work. Transcripts and letters of recommendation must be filed with the application by March 15 of the year in which graduate work is to be started. Applications must be made on forms secure from the Dean of the Graduate Engineering Programs.

REGISTRATION

At the beginning of each academic term, all students must register in the Graduate School office.

FEES

Tuition is \$225 per term. An application fee of \$10 is payable at the time of the first registration.

A graduation fee of \$20 is payable on or before May 1st of the year in which the student expects to receive his degree.

REQUIREMENTS FOR THE DEGREE OF MASTER OF SCIENCE

A total of thirty semester hours of work, which may include thesis, is required. The curricula of the programs are specified by the departments.

THESIS

The regulations concerning the forms of the thesis may be obtained from the Graduate School office or the head of the department concerned.

SCHOLASTIC PERFORMANCE

Each student must maintain a standard of performance acceptable to the Committee on Graduate Engineering Study.

WORK AND ACADEMIC SCHEDULES

Students will be assigned to Division A or Division B. Division A students will start the fall term of graduate courses on September 12, 1960 while Division B students will start their employment on this date. Each term runs for ten weeks after which there is an alternation of work and graduate courses as outlined. The curricula are shown in the sections describing the courses of the respective departments.

	<i>Sept. 12</i>	<i>Nov. 21</i>	<i>Jan. 30</i>	<i>April 10</i>	<i>June 16</i>
	10 weeks	10 weeks	10 weeks	10 weeks	
Class Periods	Div. A	Div. B	Div. A	Div. B	
Work Periods	Div. B	Div. A	Div. B	Div. A	

EVENING PROGRAM

ADMISSION

For admission to the Evening Graduate Program, applicants must have a bachelor's degree from an accredited program in the appropriate field. A personal interview with the Dean of Graduate Engineering Programs is required of all students wishing to enter any of the programs. A transcript of the applicant's prior college training should be presented at that time; if this is not possible, such material should be filed within six weeks after registration. No second registration will be allowed, nor will any grades of courses taken in the first registration period be issued until a transcript has been received and reviewed.

REGISTRATION

At the beginning of each semester, all students must register in the Graduate School office at the times indicated on the calendar.

Students in the evening part-time program, after a review of their transcript, will be classified as regular or special.

Regular Students: Students who have a bachelor's degree from an accredited program with acceptable quality of undergraduate work are designated as Regular Students.

Special Students: Students whose undergraduate record is not acceptable for regular classification are designated as Special Students.

DEGREE CANDIDACY

Admission to a course or courses does not constitute acceptance as a candidate for a Master's degree.

A student who has achieved regular classification and who has completed twelve credits of required courses in his major with a grade of B or better, will be admitted to degree candidacy.

REQUIREMENTS FOR THE DEGREE OF MASTER OF SCIENCE

Thirty semester hours of course work are required for the degree of Master of Science. The programs of required and elective courses are given in a later section.

To make an effective total program, the selection of elective courses may be one of penetration and specialization in a given field, or it may be one cutting across related fields giving supporting breadth to the student's education. Department heads and the Dean of the Graduate Engineering Programs are readily available for counsel in the selection of electives. In every case the student must be able to comply with the prerequisites or preparation requirements of his course selections.

STUDY LOAD

All graduate students are limited to a program of four semester hours of course work per semester unless granted special permission to carry a heavier course load. Thus, those who carry two evenings a week (four semester hours of course work) continuously for both semesters may complete the requirements of thirty semester hours for the degree within four years. Some students may find it possible to shorten this period to three years by enrolling in the Summer Sessions.

GRADING SYSTEM

The performance of students in graduate courses will be recorded by the instructor by use of the following grades:

A Excellent

This grade is given to those students whose performance in course has been of very high graduate caliber.

B Satisfactory

This grade is given to those students whose performance in the course has been at the level necessary for graduate credit.

C Fair

This grade is used to indicate that the student's performance in the course may be acceptable but is not consistently at the level expected in graduate work.

F Failure

This grade is used to indicate unsatisfactory work.

In addition, the following letter designations are used:

E Course registration canceled for nonattendance.

I Incomplete, without quality designation. This is used when a student does not take the final examination or otherwise fails to complete the work of the course.

S Satisfactory, without quality designation. This is used for thesis work.

W Withdrawn without prejudice.

An average of not less than B must be obtained in thirty course credits in order to qualify for the master's degree. If a grade of F is obtained in a required course, the course must be repeated and a grade of B or better obtained. If a grade of F is obtained in an elective course, this course may either be repeated or another elective course substituted for it. In the case of a repeated elective course, a grade of B must be obtained. A maximum of thirty-four course credits may be undertaken in qualifying for the degree.

The designation "I" will be changed to a grade upon removal of the "I" provided deficiencies are made up by the end of the semester following the one in which the "I" was reported. If the course deficiencies are not made up within the specified time, the grade of "I" will automatically become a grade of F. Missed final examinations can-

not be made up without the approval of the Dean or Director of the program involved. Approval for such make-up is given only for emergency reasons and must be obtained within one month following the date of the missed examination.

WITHDRAWALS

No withdrawal from a course is allowed after the tenth class session. Any student who is absent from three class periods in succession without excuse is dropped from the class.

The University provides all instruction and accommodations on an academic semester basis; therefore, no refunds are granted except in cases where students are compelled to withdraw because of personal illness or other reasons beyond their control. A student must complete an official withdrawal application at the Graduate School office before being considered for a refund. In no case are refunds made after a student has attended the fifth session of a class. Questions regarding refunds should be discussed with the Bursar's office.

TIME LIMITATIONS

Course credits earned in the program of graduate study are valid for a maximum period of eight years. This time limitation is likewise applicable to any offered transfer credits.

TRANSFER OF CREDITS

Not more than eight semester hours of graduate credit may be transferred from other institutions towards the degree of Master of Science at Northeastern University. Grades in courses offered for transfer must be B or higher. Acceptance of credits for transfer will not be approved until the student is admitted to candidacy, and then only if the work submitted for transfer credit is consonant with the objective of the approved program.

TUITION AND FEES

The policies governing the amount and the regulations pertaining to the payment of tuition and fees are established by the Executive Council of Northeastern University. The Council reserves the right to change these regulations at any time. Such changes will apply to students currently enrolled as well as new applicants for admission.

1. *Schedule of Tuition and Fees*

Application Fee—payable at time of first registration \$10.00

Matriculation Fee—for establishment of degree candidacy for students who have been in registration prior to September, 1959	10.00
Tuition—per course	60.00
Late Payment Fee—for failure to pay tuition on specified date	2.00
Make-up Final Examination Fee	5.00
Graduation Fee—payable on or before May 1 of year in which student expects to graduate	20.00

2. *Payments*

Tuition statements will be mailed to the students by the Student Accounts Office and are payable on or before the date specified.

Checks should be drawn payable to "Northeastern University."

VETERANS

Veterans who expect to obtain educational benefits from the Veterans Administration should visit the Northeastern University Veterans Office, Room 245, Richards Hall, prior to registration. The Veterans Office at Northeastern University is operated by the University and is prepared to give any assistance the veteran may require in obtaining Veterans benefits.

CLASS HOURS, INSTRUCTIONAL CALENDAR

During the first and second semesters each course meets one evening per week for two hours for sixteen weeks, including the final examinations. In the summer session each course meets twice a week for a period of eight weeks. For opening and closing dates of these sessions, consult the Academic Calendar of this Bulletin.

INTERVIEW AND REGISTRATION DATES, OFFICE HOURS, AND CLASS SCHEDULES

For dates of the interview and registration periods and office hours, consult the inside front cover. The registration circulars issued in August, January, and May provide information regarding class meeting times and teaching staff as well as listing the course offerings for the First Semester, Second Semester, and Summer Session, respectively. Copies of these circulars may be obtained from the Office of the Dean of the Graduate Engineering Programs, Northeastern University, Boston 15, Massachusetts, or by calling Copley 7-6600.

**Curricula
and
Course Descriptions**

The curricula of the various degree programs are given under each departmental heading. The descriptions of courses offered by the several departments are given so that prospective students may obtain a view of the course coverage. Preparation courses are indicated in each instance. Not all courses are offered every year, but the course offerings will be arranged in such a manner that students may make continuous progress toward the degree.

The number of students enrolled in each class will be limited to permit effective teaching at the graduate level and the University reserves the right to cancel any course for which an insufficient number of students apply.

One semester hour credit is awarded for the work represented by a class meeting for one hour each week for one regular sixteen-week semester. Each of the courses numbered over 100 carry two semester hours credit. Courses numbered below 100 are those offered for students who need to make-up certain undergraduate deficiencies. These courses carry no graduate credit.

CIVIL ENGINEERING

GRADUATE CO-OPERATIVE PROGRAM

CURRICULUM—MASTER OF SCIENCE IN CIVIL ENGINEERING

FIRST YEAR

First Term		Second Term	
1.401	Indeterminate Structures. 2	1.402	Indeterminate Structures. 2
1.503	Soil Mechanics 2	1.504	Soil Mechanics 2
2.201	Theory of Elasticity 2	2.202	Theory of Elasticity 2
4.101	Advanced Mathematics .. 2	14.102	Advanced Mathematics .. 2
	—		—
	8		8

SECOND YEAR

First Term		Second Term	
1.403	Indeterminate Structures. 2	1.506	Soil Testing Laboratory .. 2
1.505	Soil Mechanics 2	1.602	Design of Structures 2
1.601	Design of Structures 2	1.902	Thesis or Electives 2
1.901	Thesis or Electives 2		—
	—		6
	8		

EVENING PART-TIME PROGRAMS

CURRICULUM—MASTER OF SCIENCE IN CIVIL ENGINEERING

Applicants for this program should have a Bachelor of Science in Civil Engineering.

Required Courses:

STRUCTURES MAJOR		SANITARY MAJOR	
1.401, 402, 403		1.201, 202	
Indeterminate Structures	6	Sanitary Engineering	4
1.503, 504, 505		1.203	
Soil Mechanics	6	Sanitary Chemistry	2
1.601, 602		1.204	
Design of Structures	4	Sanitary Bacteriology	2
—		1.205a, 205b	
	16	Sanitary Analysis	4
		1.206a, 206b	
		Sanitary Laboratory	4
			16

Elective Credits:

Fourteen semester hours may be selected from the preferred elective group given below or from any of the course offerings of the Graduate Engineering or Science Programs, provided the student has the required preparation and/or prerequisites.

Preferred Electives:

1.208 Industrial Waste	2	2.200 Advanced Mechanics	
1.209 Stream Sanitation	2	of Materials	2
1.211, 212		2.201, 202	
Advanced Hydraulics	4	Theory of Elasticity	4
1.213, 214 Hydrology	4	2.203 Advanced Mechanics of	
1.404 Indeterminate Structures	2	Materials	2
1.501, 502 Cement and		2.213, 214 Advanced Dynamics	4
Concrete Technology	4	9.950 The Systems Approach	2
1.506 Soil Testing Lab	2	14.101, 102	
1.605 Prestressed Concrete	2	Advanced Mathematics	4

DESCRIPTION OF COURSES

1.201 Sanitary Engineering (Offered yearly, 1st sem.)

Preparation: A two-semester undergraduate course in Sanitary Engineering

Course Content: The theory and practice of water treatment and the basic design of water treatment works, including: slow sand filtration, sedimentation, coagulation, rapid sand filtration, softening, disinfection, corrosion control, iron removal, and fluoridation.

1.202 Sanitary Engineering (Offered yearly, 2nd sem.)

Preparation: A two-semester undergraduate course in Sanitary Engineering

Course Content: The theory and practice of sewage treatment and the basic design of sewage treatment works, including: requirements of receiving waters, screening, grit removal, sedimentation, Imhoff tanks, chemical treatment, trickling filters, sand filters, activated sludge process, treatment and disposal of sludge in digesters, drying beds and filters, and disinfection.

1.203 Sanitary Chemistry (Offered 1961-62, 1st sem.)

Preparation: Two semesters of undergraduate General Chemistry

Course Content: An advanced course of general chemistry stressing the basic chemical laws as they apply to the field of sanitary engineering. The course would encompass the following: fundamental laws, stoichiometry, gas laws, atomic structure, periodic system, hydrogen, alkali metals, halogens, oxygen group, aluminum group, carbon, nitrogen group, iron and manganese, acidimetric normality, oxidation and reduction, and oxidation potential.

1.204 Sanitary Bacteriology (Offered 1961-62, 2nd sem.)

Preparation: 1.203 Sanitary Chemistry

Course Content: A course of study in the field of bacteriology with emphasis on those phases of bacteriology employed by the sanitary engineer, namely, growth, form, environment, enzymes, disinfection, carbon cycle, nitrogen cycle, molds, yeasts, iron bacteria, sulphur bacteria, bacteriology of water and sewage, bacteriology of milk, swimming pools, and quantitative bacteriology.

1.205a Sanitary Analysis (Offered 1960-61, 1st sem.)

Prerequisite: 1.203 Sanitary Chemistry and 1.204 Sanitary Bacteriology

Course Content: A laboratory course applying the principles of quantitative chemical analysis to the treatment of water and sewage. "Standard Methods" of analysis of water and sewage (chemical and bacteriological) are employed. The writing and interpretation of sanitary reports are stressed.

1.205b Sanitary Analysis (Offered 1960-61, 2nd sem.)

Preparation: 1.205a Sanitary Analysis

Course Content: A continuation of the laboratory course of 1.205a. Further analysis of water and sewage is pursued. The reporting and interpretation of sanitary reports are again stressed.

1.206a Sanitary Laboratory (Offered 1961-62, 1st sem.)

Prerequisite: 1.205b Sanitary Analysis

Course Content: A laboratory course studying water purification and the writing of reports on the following topics: aeration, coagulation, odor and taste removal, corrosion, and softening.

1.206b Sanitary Laboratory (Offered 1961-62, 2nd sem.)

Preparation: 1.206a Sanitary Laboratory

Course Content: A continuation of course 1.206a, but studying sewage treatment and written reports on the following topics: B. O. D., chemical precipitation, sludge filtration, chlorination, activated sludge, and sludge digestion.

1.208 Industrial Waste (Offered 1960-61, 1st sem.)

Preparation: 1.203 Sanitary Chemistry and 1.204 Sanitary Bacteriology

Course Content: A study of various manufacturing processes and their waste problems, together with methods of utilization, treatment, and disposal of their waste products. Specific processes that can be adapted to specific waste and their necessary concomitant structures are studied with the viewpoint of designing suitable treatment plants.

1.209 Stream Sanitation (Offered 1960-61, 2nd sem.)

Preparation: 1.203 Sanitary Chemistry and 1.204 Sanitary Bacteriology

Course Content: This course deals with the basic principles of stream sanitation and corrective control methods. The topics taken up in this course include the following: aerobic and anaerobic decomposition, oxygen balance, carbon dioxide, oxidation, reduction, bacterial pollution, industrial pollution, sewage pollution, water supply, shellfish, fish life, riparian rights, recreation, and general stream sanitation.

1.211 Advanced Hydraulics (Offered 1961-62, 1st sem.)

Preparation: Two semesters of undergraduate Hydraulics

Course Content: An advanced course in Hydraulics, presenting the following concepts: energy, continuity, momentum, flow nets, significance of the Froude and Reynolds numbers, fluid motion in a closed conduit, open channels, surface resistance, dimensional analysis, dynamic similarity, theory of models, and pipe networks.

1.212 Advanced Hydraulics (Offered 1961-62, 2nd sem.)

Preparation: 1.211 Advanced Hydraulics

Course Content: A continuation of course 1.211, with further study of open channel flow, backwater curve, drawdown curve, hydraulic jump, location of hydraulic jump, transitions in channels, theory of waves, cavitation, and water hammer.

1.213 Hydrology (Offered 1960-61, 1st sem.)

Preparation: Undergraduate courses in Differential and Integral Calculus

Course Content: A study of the principles of statistical methods as applied to Hydraulic and Sanitary Engineering.

1.214 Hydrology (Offered 1960-61, 2nd sem.)

Preparation: 1.213 Hydrology

Course Content: A continuation of course 1.213, emphasizing the following: the collection and sampling of raw data with an aim to predicting such phenomena as precipitation, run-off, floods, and stream flow. Analysis, correlation, and accuracy of these predictions are studied and compared by arithmetic and graphical methods.

1.401 Indeterminate Structures (Offered yearly, 1st sem.)

Preparation: Undergraduate courses in Differential and Integral Calculus and Theory of Structures

Course Content: Analysis of structures starting with a review of elementary theory, indeterminateness, stability, deflections, and proceeding to the analysis of indeterminate beams and trusses with strain energy (Castigliano), moment area, and theorem of three moments.

1.402 Indeterminate Structures (Offered yearly, 2nd sem.)

Preparation: 1.401 Indeterminate Structures

Course Content: Continuation of course 1.401. Analysis of indeterminate frames, arches, and trusses by virtual work, slope deflection, and moment distribution. Effect of variable stiffness considered. Column analogy.

1.403 Indeterminate Structures (Offered yearly, 1st sem.)

Prerequisite: 1.402 Indeterminate Structures

Course Content: Continuation of course 1.402. Shear and moment distribution in the analysis of broken-story frame building for horizontal and vertical loads. Influence lines for indeterminate frames and trusses. Cables and suspension systems. Circular domes. Planar structure analyzed for loads perpendicular to its plane. Space frameworks. Introduction to Relaxation Methods.

1.404 Indeterminate Structures (Offered 1960-61, 2nd sem.)

Preparation: 1.403 Indeterminate Structures

Course Content: Included in this course are the following: Southwell's Relaxation Method, its application to pin-jointed frameworks and to rigid-jointed frameworks; secondary stresses in trusses, by classical methods and by iterative methods; analysis of towers and cables for electrical transmission lines, catenaries on inclined spans, and bimetallic cables.

1.501 Cement and Concrete Technology (Offered yearly, 1st sem.)

Preparation: Undergraduate course in Materials of Engineering

Course Content: The following topics are considered: manufacture, physical and chemical properties of the various types of Portland cement, chemical and physical properties of aggregates, control of concrete materials, concrete mix design methods, factors affecting the properties of plastic concrete and concrete mix control. Three laboratory periods will be held during this semester.

1.502 Cement and Concrete Technology (Offered yearly, 2nd sem.)

Preparation: 1.501 Cement and Concrete Technology

Course Content: A continuation of course 1.501, studying the following: physical properties and durability of hardened concrete, effect of aggregate characteristics on properties of concrete, including alkali-aggregate reactions, consideration of admixtures used in concrete manufacture such as air-entrainment, wetting, dispersion, pozzolanic materials, and use of lightweight aggregates. Special topics such as "Pumps-crete" methods, intrusion (Prepakt) concrete, soil cement, and dynamic modulus will be discussed. Two laboratory periods will be held during this semester.

1.503 Soil Mechanics and Foundation Engineering

(Offered yearly, 1st sem.)

Preparation: Undergraduate courses in Differential and Integral Calculus

Course Content: Phase relationships; soil classification and identification; subsurface explorations; seepage and ground water flow; theory of consolidation.

1.504 Soil Mechanics and Foundation Engineering

(Offered yearly, 2nd sem.)

Preparation: 1.503 Soil Mechanics and Foundation Engineering

Course Content: Stress distribution, settlement analyses; stress deformation and strength properties; stability of slopes and embankments.

1.505 Soil Mechanics and Foundation Engineering

(Offered yearly, 1st sem.)

Prerequisite: 1.504 Soil Mechanics and Foundation Engineering

Course Content: Lateral pressures; retaining wall and bulkhead design; bearing capacity of footings, piers, pile foundations; practical applications; uncertainties in design assumptions.

1.506 Soil Testing Laboratory (Offered yearly, 2nd sem.)

Preparation: 1.503 Soil Mechanics and Foundation Engineering

Course Content: A laboratory course covering classification tests (Atterberg limits, specific gravity and grain size analysis), compaction, permeability, consolidation, strength characteristics (unconfined compression, triaxial compression and California Bearing Ratio) and field control tests.

1.601 Design of Structures (Offered yearly, 1st sem.)

Prerequisite: 1.402 Indeterminate Structures

Course Content: An advanced course in structural design of steel and concrete including: critical inspection of building frames with emphasis on economics and selection of type, loft buildings, tall buildings, mill buildings, wind forces, and riveted and welded wind bracing connections.

1.602 Design of Structures (Offered yearly, 2nd sem.)

Preparation: 1.601 Design of Structures

Course Content: A continuation of course 1.601, including the following topics: columns, columns in bending, requirements for lateral support, prestressing in steel and concrete, design of structures for dynamic loads, stress design vs. limit design, and timber design.

1.605 Prestressed Concrete (Offered yearly, 2nd sem.)

Preparation: Undergraduate course in Reinforced Concrete Design

Course Content: The following topics are considered: basic design concepts, properties of materials used for prestressing, review of research in prestressed concrete, construction practice covering various methods of both pre-tensioning and post-tensioning used to date, discussion of tests, and economics of prestressed concrete.

1.901 THESIS (Open only to co-operative students)

Course Content: Analytical and/or experimental work conducted under the auspices of the department.

1.902 THESIS

Course Content: A continuation of 1.901

MECHANICAL ENGINEERING

GRADUATE CO-OPERATIVE PROGRAM

CURRICULUM— MASTER OF SCIENCE IN MECHANICAL ENGINEERING

FIRST YEAR

First Term		Second Term	
2.201	Theory of Elasticity 2	2.202	Theory of Elasticity 2
2.211	Vibration Theory 2	2.212	Vibration Theory 2
14.101	Advanced Mathematics . . . 2	14.102	Advanced Mathematics . . . 2
	Electives 2		Electives 2
	8		8

SECOND YEAR

First Term		Second Term	
2.213	Advanced Dynamics 2	2.214	Advanced Dynamics 2
2.901	Thesis or Electives 2	2.902	Thesis or Electives 2
	Electives 4		Electives 2
	8		6

EVENING PART-TIME PROGRAMS

CURRICULUM—

MASTER OF SCIENCE IN MECHANICAL ENGINEERING

Applicants for this program should have a Bachelor of Science degree in Mechanical Engineering.

Required Courses:

MECHANICS MAJOR

2.201, 202	Theory of Elasticity	4
2.213, 214	Advanced Dynamics	4
2.211, 212	Vibration Theory	
or		
2.221, 222	Fluid Dynamics	4
14.101, 102	Advanced Mathematics	4
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HEAT-POWER MAJOR

2.301, 302	Heat Transfer	4
2.311, 312	Advanced Thermodynamics	4
2.501, 502	Power Plant Economics	4
14.101, 102	Advanced Mathematics	4
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Elective Courses:

Eight semester hours must be selected from the preferred elective courses listed below. These preferred elective courses must have the approval of the Chairman of the Department of Mechanical Engineering or the Dean of the Graduate Engineering Programs. Six additional semester hours may be selected from any of the course offerings of the Graduate Engineering or Science Programs provided the student has the required preparation and/or prerequisites.

Preferred Electives:

2.200	Advanced Mechanics of Materials	2	2.402	Fans and Blowers	2
2.203	Advanced Mechanics of Materials	2	2.511, 512	Power Plant Design	4
2.205	Experimental Stress Analysis	2	2.701, 702	Physical Metallurgy	4
2.207	Theory of Plasticity	2	2.707, 708	Process Metallurgy	4
2.240	Advanced Kinematics	2	2.709, 710	Advanced Physical Metallurgy	4
2.250	Advanced Machine Design	2	2.801	Fundamentals of Instrumentation	2
2.260	Dynamical Problems in Machine Design	2	2.802	Industrial Process Control	2
2.401	Pumps	2	2.803	Automatic Control Engineering	2
			9.950	The Systems Approach	2
			15.223, 224	Nuclear Physics for Engineers	4

EVENING PART-TIME PROGRAMS

CURRICULUM—

MASTER OF SCIENCE IN ENGINEERING MECHANICS

Applicants for this program should have a Bachelor of Science degree in engineering supported by appropriate concentration in the area of undergraduate Mechanics.

Required Courses:

2.201, 202	Theory of Elasticity.	4	2.211, 212	Vibration Theory	
2.213, 214	Advanced Dynamics.	4	or		
		—	2.221, 222	Fluid Dynamics	4
		8	14.101, 102	Advanced	
				Mathematics	4
					—
					8

Elective Courses:

Eight semester hours must be selected from the preferred elective courses listed below. These preferred elective courses must have the approval of the Chairman of the Department of Mechanical Engineering or the Dean of the Graduate Engineering Programs. Six additional semester hours may be selected from any of the course offerings of the Graduate Engineering or Science Programs provided the student has the required preparation and/or prerequisites.

Preferred Electives:

2.200	Advanced Mechanics of		2.240	Advanced Kinematics . . .	2
	Materials	2	2.250	Advanced Machine Design	2
2.203	Advanced Mechanics of		2.260	Dynamical Problems in	
	Materials	2		Machine Design	2
2.205	Experimental Stress		9.950	The Systems Approach . .	2
	Analysis	2			
2.207	Theory of Plasticity	2			

DESCRIPTION OF COURSES

2.200 Advanced Mechanics of Materials

(Offered yearly, 1st and 2nd sem.)

Preparation: Strength of Materials

Course Content: Stresses at a point, theories of failure, thick cylinders under elastic and plastic deformation, shear stress distribution, location of shear center, bending stresses due to non-symmetrical loading, bending of flat plates, curved beams, the significance of fatigue, stress concentration, the resistance of materials to stress. Experimental methods and practical problems are discussed.

2.201 Theory of Elasticity (Offered yearly, 1st sem.)

Preparation: One year of Strength of Materials, 14.101 Advanced Mathematics (may take simultaneously).

Course Content: Analysis of stress and strain in two and three dimensions, principal stresses and strains, differential equations of equilibrium, boundary conditions, compatibility equations, stress function, determination of displacements, equilibrium conditions in terms of displacements. Solution of problems in two dimensions.

2.202 Theory of Elasticity (Offered yearly, 2nd sem.)

Preparation: 2.201 Theory of Elasticity, 14.102 Advanced Mathematics (may take simultaneously).

Course Content: A continuation of 2.201 with application to the solution of problems in three dimensions.

2.203 Advanced Mechanics of Materials (Offered 1960-61, 2nd sem.)

Prerequisite: Differential Equations and 2.200 Advanced Mechanics of Materials

Course Content: Buckling of compression members with and without transverse loads; eccentricity and curvature, comparison of general design expressions for columns, torsion of non-circular sections, contact stresses, solution of plates by grid analogy.

2.205 Experimental Stress Analysis (Offered yearly, 2nd sem.)

Prerequisite: 2.200 Advanced Mechanics of Materials or equivalent

Course Content: Theoretical and practical consideration of methods of determining stress distributions. The fundamental theory basic to the various methods will be emphasized and a comparison of the results obtainable by these methods will be made. Photoelasticity, brittle lacquers, strain gauge techniques, and instrumentation are a few of the methods given consideration.

2.207 Theory of Plasticity (Offered 1960-61, 1st sem.)

Prerequisite: 2.202 Theory of Elasticity

Course Content: The mathematical theory of plasticity and its engineering

applications; the laws of plastic flow; general stress-strain relations, plastic flow in thick-walled bodies, plastic torsion.

2.211 Vibration Theory and Applications (Offered yearly, 1st sem.)

Preparation: Differential Equations, Dynamics

Course Content: Single degree of freedom; damping, forced vibration, resonance, phase relationships, vibration isolation, multiple degrees of freedom; free and forced vibration with and without damping, extensional and torsional oscillations and electrical analogies, frequency equation, energy in a vibrating system, energy methods of solution, Rayleigh's Method.

2.212 Vibration Theory and Applications (Offered yearly, 2nd sem.)

Preparation: 2.211 Vibration Theory and Applications

Course Content: A continuation of 2.211 including systems with distributed mass and stiffness, critical speeds of shafts, engine balancing, stability criteria, gyroscope, non-linear vibrations, experimental study of vibrations, graphical and semigraphical analysis, Fourier analysis.

2.213 Advanced Dynamics (Offered yearly, 1st sem.)

Preparation: Dynamics, 14.101 Advanced Mathematics (may take simultaneously).

Course Content: Application of fundamental laws of motion. Dynamics of a particle, rectilinear motions in a resisting medium, linear and non-linear vibrations, motion in a plane, motion of a projectile. Linear and angular momentum, impact.

2.214 Advanced Dynamics (Offered yearly, 2nd sem.)

Preparation: 2.213 Advanced Dynamics, 14.102 Advanced Mathematics (may take simultaneously).

Course Content: Further applications of laws of motion. Engine balancing, kinetic energy and work, dynamics of systems with constraints, generalized coordinates, LaGrangian Equations, Hamilton's Principle, Euler's Equations, rotation of a rigid body.

2.221 Fluid Dynamics (Offered yearly, 1st sem.)

Preparation: Hydraulics, Dynamics, 14.102 Advanced Mathematics

Course Content: Principles of incompressible fluid flow in two and three dimensions, stream function, velocity potential, application of complex variables, analytic functions, orthogonal nets, conformal maps, two and three dimensional flow problems.

2.222 Fluid Dynamics (Offered yearly, 2nd sem.)

Preparation: 2.221 Fluid Dynamics

Course Content: Continuation of two dimensional incompressible flow problems by conformal mapping, Blasius theorem, Jonkowski airfoils, Schwarz-Christoffel theorem, free streamlines, Vortex flow, introduction to boundary layer theory.

2.240 Advanced Kinematics (Offered 1960-61, 1st sem.)

Preparation: Kinematics

Course Content: Geometry of constrained motion, with applications to point paths; kinematic analysis and synthesis; types of mechanisms; study of geometry of constrained motion in two and three dimensions.

2.250 Advanced Machine Design (Offered 1960-61, 1st sem.)

Preparation: 2.200 Advanced Mechanics (or equivalent), Dynamics, Machine Design.

Course Content: Analysis, layout, and design of machines and machine parts.

2.260 Dynamical Problems in Machine Design

(Offered 1960-61, 2nd sem.)

Preparation: 2.214 Advanced Dynamics

Course Content: Methods for determining dynamic characteristics of mechanisms. Design of devices for specific velocities and accelerations under given force systems.

2.301 Heat Transfer (Offered 1960-61, 1st sem.)

Preparation: Elements of Heat Transfer, 14.102 Advanced Mathematics

Course Content: Heat Transfer by conduction in steady state, two dimensional applications, cylindrical coordinates, relaxation method, field mapping solutions, non-steady state conduction, heating and cooling of solids, Schmidt's method and electrical analogy solutions. Radiation, basic definitions, theoretical aspects, application to engineering problems, geometry factor, Hottel's determinant type solutions, gas radiation and furnace design.

2.302 Heat Transfer (Offered 1960-61, 2nd sem.)

Preparation: 2.301 Heat Transfer

Course Content: Dimensional analysis; Reynolds, Prandtl and Nusselt numbers; Reynolds analogy; elements of boundary layer theory and contributions of Prandtl, Taylor, von Karman and Martinelli; forced convection, natural convection, condensation and boiling; Nusselt's derivation; analogy of heat and mass transfer, diffusion of fluids and application to drying problems.

2.311 Advanced Thermodynamics (Offered yearly, 1st sem.)

Preparation: Thermodynamics, Differential Equations

Course Content: Laws of thermodynamics, properties of substances, steady and unsteady flow, reversibility, contributions of Carnot and Clausius, ideal gases, gas and steam tables, mixtures of ideal gas, air-water mixtures, processes involving chemical reactions and mixing.

2.312 Advanced Thermodynamics (Offered yearly, 2nd sem.)

Preparation: 2.311 Advanced Thermodynamics

Course Content: Thermodynamic relations for pure substances, contributions of Maxwell, Clapeyron, Gibbs, Helmholtz, Vander Waal and Beattie-Bridg-

man; law of corresponding states; thermodynamics of chemistry, solutions, combustion; equilibrium criteria; unstable, meta-stable, neutral and stable, and critical states; equilibrium of heterogeneous substances, chemical potential, phase rule, osmotic pressure and surface tension.

2.401 Pumps (Offered 1960-61, 1st sem.)

Preparation: Hydraulics

Course Content: Flow of fluids in pipes and ducts, head on pumps, fans and blowers; development of head, net positive suction head, cavitation and specific speed of pumps; affinity laws, selection of pumps to suit various operating conditions and methods of driving; automatic operation, types of construction and materials used, methods of priming centrifugal pumps, pumping of chemicals, oils and sludges, special problems of pump installation and operation, water hammer in pump discharge lines.

2.402 Fans and Blowers (Offered 1960-61, 2nd sem.)

Preparation: 2.401 Pumps, Thermodynamics

Course Content: Flow of air in pipes and ducts, fan characteristics and laws, various types of fan wheels, inlet and outlet connections, fan capacity control, fan selection and testing. Compression of air and gases, flow in pipes, head on blowers, performance curves, effect of changes in speed and inlet conditions, construction, regulation, selection, installation and testing. Axial flow fans and blowers. Positive pressure blowers.

2.501 Power Plant Economics (Offered 1961-62, 1st sem.)

Preparation: Thermodynamics

Course Content: Cost of power and heat as required by various types of factories, hospitals, and other large buildings. Distribution of steam to groups of buildings for the most economical use of steam. Effective use of exhaust and bled steam for process, heat and air conditioning. Costs of power and heat by an isolated plant compared to that of purchased power.

2.502 Power Plant Economics (Offered 1961-62, 2nd sem.)

Preparation: 2.501 Power Plant Economics

Course Content: A continuation of 2.501, including computations covering an isolated steam plant with supplementary Diesel equipment and public utilities breakdown connections.

2.511 Power Plant Design (Offered 1960-61, 1st sem.)

Preparation: 2.312 Advanced Thermodynamics

Course Content: Latest development in the theory and design of modern power generation for isolated and central stations. Computations for a small central station involving the size and type of boiler, prime movers, feed water heater, pumps, coal handling equipment.

2.512 Power Plant Design (Offered 1960-61, 2nd sem.)

Preparation: 2.511 Power Plant Design

Course Content: A continuation of 2.511, including an analysis and computations covering equipment for an isolated plant, including steam generating units, engines or turbines, condensing equipment, piping and general auxiliaries.

2.701 Physical Metallurgy (Offered yearly, 1st sem.)

Preparation: Engineering Materials

Course Content: Introduction to Physical Metallurgy encompassing Crystallography; equilibrium and nonequilibrium phase studies for 1, 2 and 3 component systems; theory of mechanical working of metals including elastic and plastic deformation, impact, fatigue, and creep; and theories of relieving work effects including recovery, recrystallization, and grain growth.

2.702 Physical Metallurgy (Offered yearly, 2nd sem.)

Preparation: 2.701 Physical Metallurgy

Course Content: The application of Physical Metallurgy theories to the study of the chemical and physical properties of iron, cast iron, steel, copper and nickel base alloys, aluminum, magnesium, and titanium.

2.707 Process Metallurgy (Offered 1960-61, 1st sem.)

Preparation: Engineering Materials

Course Content: Vacuum systems; high temperatures, measurement and control; atmospheres; heat treating techniques; preparation of pure metals and single crystals; powder metallurgy; X-ray radiography.

2.708 Process Metallurgy (Offered 1960-61, 2nd sem.)

Preparation: 2.707 Process Metallurgy

Course Content: Melting and casting; hot working processes; cold working processes; welding and alloy processes; mechanical working; cleaning and plating; gauging inspection and nondestructive testing.

2.709 Advanced Physical Metallurgy (Offered 1961-62, 1st sem.)

Preparation: Calculus and one year of physical chemistry, or 2.702 Physical Metallurgy

Course Content: Dislocation theories, electrical and magnetic properties of metals; deformation of metals; effect of permanent deformation; effects of elevated temperature; theories of oxidation; fracture.

2.710 Advanced Physical Metallurgy (Offered 1961-62, 2nd sem.)

Preparation: Calculus and one year of physical chemistry, or 2.702 Physical Metallurgy

Course Content: Nucleation processes and structure of castings; allotropic transformations; phase rule and interpretation of equilibrium diagrams; solid-solid phase transformations; diffusion and age-hardening.

2.801 Fundamentals of Instrumentation (Offered yearly, 1st sem.)

Preparation: Bachelor of Science degree

Course Content: Theoretical principles underlying the design and operation of instruments for measurement and/or control. Analysis of stimulus-response relations. Industrial instruments for measurement and control, including those based on pneumatic and electrical mechanisms.

2.802 Industrial Process Control (Offered 1960-61, 2nd sem.)

Preparation: 2.801 Fundamentals of Instrumentation

Course Content: Fundamental principles involved in automatic control of industrial processes. Economic considerations. Application of control instruments to obtain automatic control of temperature, pressure, fluid flow, liquid level, humidity, pH.

2.803 Automatic Control Engineering (Offered 1961-62, 2nd sem.)

Preparation: Differential Equations and 2.801 Fundamentals of Instrumentation

Course Content: Fundamental principles of feedback systems, stability criteria, proportional derivative and integral action, physical components of feedback systems.

2.901 THESIS (Open only to co-operative students)

Course Content: Analytical and/or experimental work conducted under the auspices of the department.

2.902 THESIS

Course Content: A continuation of 2.901.

ELECTRICAL ENGINEERING GRADUATE CO-OPERATIVE PROGRAM

CURRICULUM—

MASTER OF SCIENCE IN ELECTRICAL ENGINEERING

FIRST YEAR

First Term

3.203	Analog & Digital Comp...	2
3.401	Transients in Linear Sys.	2
14.105	Advanced Mathematics ..	2
	Electives	2
		8

Second Term

3.402	Transients in Linear Sys.	2
3.901	Electric Circuit Theory ..	2
3.951	Seminar	2
	Electives	2
		8

SECOND YEAR

First Term

3.902	Electric Circuit Theory ..	2
3.953	Thesis or Electives	2
14.106	Advanced Mathematics ..	2
	Electives	2
		8

Second Term

15.105	Advanced Physics	2
3.954	Thesis or Electives	2
	Electives	2
		6

EVENING PART-TIME PROGRAMS

CURRICULUM—

MASTER OF SCIENCE IN ELECTRICAL ENGINEERING

Applicants for this program should have a Bachelor of Science degree in Electrical Engineering.

Required Courses:

ELECTRONICS-COMMUNICATION MAJOR

3.401, 402	Transients in Linear Systems	4
3.901, 902	Electric Circuit Theory	4
14.101, 102	Advanced Mathematics	4
15.101, 102	Theoretical Physics ..	4
	—	
		16

ELECTRIC-POWER MAJOR

3.401, 402	Transients in Linear Systems	4
3.611, 612	Advanced Electrical Machinery	4
3.911, 912	Electric Power Circuits	4
14.101, 102	Advanced Mathematics	4
	—	
		16

Elective Courses:

Eight semester hours must be selected from the following preferred elective courses in the student's major field. Six additional semester hours may be selected from any of the course offerings of the Graduate Engineering or Science Programs provided the student has the required preparation and/or prerequisites.

Preferred Electives:

3.101, 102, 103	Servomechanisms	6	3.601, 602	Industrial Electronics	4
3.201, 202	Pulse Circuits	4	3.605, 606	Transistor Circuit Engineering	4
3.204	Digital Computer Coding and Logic	2	3.701, 702	Electronic Engineering	4
3.215	Computing and Control Devices	2	3.801, 802	Application of Microwaves	4
3.221, 222	Radar Engineering ..	4	3.803, 804	Electromagnetic Wave Propagation ..	4
3.231, 232	Switching Circuits ..	4	3.915	Electric Power Distribution	2
3.301, 302	Theory of Microwaves	4	9.950	The Systems Approach ..	2
3.311	High-Voltage Engineering	2	15.201, 202	Modern Physics	4
3.411	Power System Stability ..	2	15.223, 224	Nuclear Physics for Engineers	4
3.412	Protective Relaying	2	15.231, 232	Solid State Physics ..	4
3.501, 502, 503	Communication Theory	6	15.250	Plasma Physics	2
			15.252	Atmospheric Physics	2

CURRICULUM—MASTER OF SCIENCE IN COMMUNICATIONS

Applicants for this program should have a Bachelor's degree with twelve semester hours of physics, including electricity and magnetism, and mathematics through differential equations.

Required Courses:

3.501	Communication Theory	2
3.901, 902	Electric Circuit Theory	4
14.101, 102	Advanced Mathematics	4
15.101, 102	Theoretical Physics	4
3.502	Communication Theory	
	or	
3.503	Communication Theory	2
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Elective Courses:

Eight semester hours must be selected from the following preferred elective courses. Six additional semester hours may be selected from any of the course offerings of the Graduate Engineering or Science Programs provided the student has the required preparation and/or prerequisites.

Preferred Electives:

3.201, 202	Pulse Circuits	4	3.801, 802	Application of	
3.204	Digital Computer Coding			Microwaves	4
	and Logic	2	14.230	Probability	2
3.215	Computing and Control		14.241	Modern Algebra	2
	Devices	2	15.223, 224	Nuclear Physics	
3.221, 222	Radar Engineering ..	4		for Engineers	4
3.231, 232	Switching Circuits ..	4	15.225	Physics of Semiconductors	2
3.301, 302	Theory of		15.226	Transistor Physics	2
	Microwaves	4	15.231, 232	Solid State Physics ..	4
3.401, 402	Transients in Linear		15.250	Plasma Physics	2
	Systems	4	15.252	Atmospheric Physics	2
3.605, 606	Transistor Circuit		15.503, 504	Electromagnetic	
	Engineering	4		Theory	4
3.701, 702	Electronic				
	Engineering	4			

DESCRIPTION OF COURSES

The present trend in the field of electrical engineering is toward a greater emphasis on physico-mathematical techniques. Hence, the electrical curricula of the contemporary graduate schools are emphasizing the analytical approach to electrical engineering problems rather than the purely empirical. Accordingly, the courses outlined below have been designed to present particularly the analytical methods used in solving various types of modern electrical engineering problems, without, however, neglecting altogether those practical considerations necessary for engineering application. Where appropriate, laboratory demonstrations and exercises have been included.

3.101 Servomechanisms Theory (Offered yearly, 1st sem.)

Preparation: Transient analysis using Laplace transforms

Course Content: A comprehensive treatment of the methods of analysis and compensation as applied to closed-loop control systems. Use of Laplace-transformation techniques for the formulation and manipulation of transfer functions and signal-flow diagrams. Frequency-response analysis with emphasis on vector-contour techniques using linear and logarithmic representation of transfer functions. Adjustments and optimum design considerations using lead and integral-compensation techniques.

3.102 Advanced Servomechanisms (Offered yearly, 2nd sem.)

Preparation: 3.101 Servomechanisms Theory

Course Content: Servomechanisms theory embodying analysis and synthesis using logarithmic representation of transfer-function vector contours. Various compensation methods and the techniques of network design. Study of dynamic characteristics of electrical, mechanical, and hydraulic components used in typical servomechanisms. Quantitative specification, design, and testing of complex feedback control systems. Class demonstrations of typical servomechanisms and components.

3.103 Advanced Feedback Control Systems (Offered 1960-61, 1st sem.)

Preparation: 3.102 Advanced Servomechanisms

Course Content: Advanced studies of feedback control systems using frequency-response techniques and compensation. Design for minimum integral-square error. System design in presence of constraints. Methods of obtaining transient response from frequency response. Introduction to root-locus method. Components performance, specification, and design. Theory of analysis of non-linear and discontinuous systems. Consideration and study of non-linear effects such as saturation, backlash, and friction. Also, the effects of discontinuities such as sampling and quantization.

3.201 Pulse and Digital Circuits (Offered yearly, 1st sem.)

Preparation: Transient analysis using Laplace transforms, electronic circuits

Course Content: A treatment of the principles and techniques of pulse-forming and pulse-processing circuits basic to radar, television, digital computation, pulse-modulation systems, and data-processing systems. A review of wave-shaping circuits and transistor-circuit fundamentals, followed by a study of wide-band linear amplifiers of pulse signals. Piecewise-linear techniques and graphical methods of analysis as applied to such non-linear circuits as clippers, clampers, binaries, multivibrators, and sweep generators. The devices considered are instrumented with tubes, semi-conductor devices such as transistors and diodes, magnetic-circuit elements, super-conductive elements, etc.

3.202 Pulse and Digital Circuits (Offered yearly, 2nd sem.)

Preparation: 3.201 Pulse and Digital Circuits

Course Content: Extension of the methods of 3.201 to the analysis and design of pulse transformers, blocking oscillators, d-c to d-c converters, delay lines, distributed-line amplifiers, counting circuits, logical circuits, gates and voltage comparators. Typical pulse and digital systems are discussed with some consideration given to receiver noise figure, and methods of improving the signal-to-noise ratio.

3.203 Introduction to Analog and Digital Computers

(Offered yearly, 1st sem., day only)

Preparation: A Bachelor of Science degree which includes coverage of electronic circuits.

Course Content: This course provides an introduction to the understanding and utilization of analog and digital computers. The elements of analog computers are discussed, including adders, integrators, multipliers and function generators. Illustrative examples are given and the scale factor problem is discussed in detail. The basic elements of digital computers are discussed, including counters, storage devices, logic circuits and input equipment. An introduction is given to programming problems for solution on digital machines.

3.204 Digital Computer Coding and Logic (Offered yearly, 1st sem.)

Preparation: A Bachelor's degree in Engineering or Science

Course Content: This course is designed as a survey of the basic logic and techniques involved in the design and use of digital computers. Topics discussed will include the following: functions of a computer, logical design, basic components, principles of coding, input and output systems.

Considerable time will be spent on the translation of arithmetical and logical operations into digital computer instructions. Examples will be taken from typical business, engineering, scientific, and real-time control problems. It is expected the course will include at least one visit to a large scale computer in the Boston area.

3.215 Computing and Control Devices (Offered yearly, 2nd sem.)

Preparation: Advanced electronic circuits, including coverage of basic pulse circuits

Course Content: Review of pulse circuit fundamentals. Engineering organization of computers. Boolean algebra; electronic switching circuits, electro-mechanical components, basic magnetic circuits; reliability techniques; acoustic, electrostatic and magnetic storage techniques; digital control units; transducers, operational-digital techniques; current and future developments.

3.221 Radar Engineering (Offered yearly, 1st sem.)

Preparation: Transients, Basic Electronic Circuits

Course Content: This course emphasizes the systems aspects of radar engineering. Included among the topics are the prediction of radar range performance; a discussion of pulsed, CW, and MTI radars; tracking radars; radar transmitters and antennas.

3.222 Radar Engineering (Offered yearly, 2nd sem.)

Preparation: 3.221 Radar Engineering

Course Content: Continuation of 3.221, a further consideration of the systems aspects of radar engineering. This course covers radar receivers; detection of radar signals in noise; electromagnetic propagation; clutter and weather effects; system design principles and examples of radar systems.

3.231 Switching Circuits (Offered yearly, 1st sem.)

Preparation: A Bachelor's degree in Engineering or Science

Course Content: Basic relay networks will be treated by the methods of switching algebra. Combinational, sequential and counting circuits will be given as well as the theory of error detecting and translating circuits.

3.232 Switching Circuits (Offered yearly, 2nd sem.)

Preparation: 3.231 Switching Circuits

Course Content: Application of the material covered in 3.231 Switching Circuits. This includes work with iterative networks, sequential circuits, and special coding techniques.

3.301 Theory of Microwaves (Offered yearly, 1st sem.)

Preparation: Advanced calculus, including coverage of Laplace's and the wave equations, vector analysis and the calculus of vectors

Course Content: The static and time-varying electric and magnetic fields. Integral and differential forms of Maxwell's equations, and boundary relations. Scalar and vector potentials. Circuit concepts at high frequencies. Poynting's vector and energy theorems. Development of wave equations. Plane waves in dielectric and conducting media.

3.302 Theory of Microwaves (Offered yearly, 2nd sem.)

Preparation: 3.301 Theory of Microwaves

Course Content: Development of transmission line equations and their solutions. Transmission line charts. TE and TM modes in hollow rectangular and circular waveguides. The impedance concept, energy density and power flow

in waveguides. General microwave-circuit theorems. The termination of a single waveguide. The junction of several waveguides. Impedance and admittance matrices. Scattering matrix.

3.311 High-Voltage Engineering (Offered 1960-61, 2nd sem.)

Preparation: A-C Theory

Course Content: Insulation of the solid and liquid types. Lightning, surge protection in general, and insulation coordination. Corona. Destructive and non-destructive testing methods.

3.401 Transients in Linear Systems (Offered yearly, 1st and 2nd sem.)

Preparation: Undergraduate course in transient analysis using Laplace transforms.

Course Content: A comprehensive treatment covering the application of Laplace transforms to the determination of the responses of representative engineering systems, including those involving electrical, mechanical, hydraulic, and thermal components.

3.402 Transients in Linear Systems (Offered yearly, 1st and 2nd sem.)

Preparation: 3.401 Transients in Linear Systems

Course Content: A continuation of 3.401 to include application to more complex systems. Complex-variable theory, as it relates to the evaluation of the inversion integral, is covered. Application is made to the determination of stability criteria and of the behavior of distributed-parameter systems. Solution of linear difference equations by the Laplace-transform method, and their applications.

3.411 Power System Stability (Offered 1961-62, 1st sem.)

Preparation: Polyphase A-C Circuits, A-C Machinery

Course Content: Includes a study of steady-state power limits and transient stability of electric power systems.

3.412 Protective Relaying, as Applied to Power Systems

(Offered 1961-62, 2nd sem.)

Preparation: Polyphase A-C Circuits, A-C Machinery

Course Content: Types of relays, calculation of short-circuit currents, the selection of the proper relay, and the solution of practical relaying problems.

3.501 Communication Theory — Introduction

(Offered yearly, 1st and 2nd sem.)

Prerequisite: 14.102 Advanced Mathematics, or 3.402 Transients in Linear Systems, or 3.902 Electric Circuit Theory.

Course Content: First of three courses on Communication Theory to present an engineering analysis of statistical communication problems. This course is designed to provide the basic tools for the study of Information theory and Detection theory which are the subject matters of the two following courses. Particular subjects include: signal theory, Fourier analysis, power spectrum and correlation function, sampling theorem, spectrum and noise in amplitude, angular and pulse modulation, an introduction to probability theory.

3.502 Communication Theory — Information Theory

(Offered 1961-62, 1st sem.)

Prerequisite: 3.501 Communication Theory — Introduction*Course Content:* Second course on Communication Theory to present an engineering analysis of statistical communication problems. This course can be taken in addition to 3.503 although it is treated independently of that course. The course deals principally with three aspects of Information Theory: the statistical measure of information, the determination of channel capacity and the fundamental coding theorems.**3.503 Communication Theory — Detection Theory**

(Offered 1960-61, 2nd sem.)

Prerequisite: 3.501 Communication Theory — Introduction*Course Content:* Third course on Communication Theory to present an engineering analysis of statistical communication problems. This course can be taken in addition to 3.502 although it is treated independently of that course. The course deals with the theories of detection and extraction of signals in the presence of noise. Particular subjects include: description of random processes, detection process as testing of hypothesis, correlation detection, matched filtering, optimum linear filtering and prediction.**3.601 Industrial Electronics** (Offered 1961-62, 1st sem.)*Preparation:* Basic Electronics and Circuits*Course Content:* Emission, conduction of gases. Thermionic vacuum and gas tubes, cold-cathode tubes, phototubes and photoelectric cells. Study of the oscilloscope; electromagnetic and electrostatic deflection and focusing in cathode-ray tubes; sweep circuits, control circuits, etc. Applications of the oscilloscope. Design and analysis of electronic circuits employing phototubes, pulsed-light sources, etc.**3.602 Industrial Electronics** (Offered 1961-62, 2nd sem.)*Preparation:* 3.601 Industrial Electronics*Course Content:* Review of meter movements. Electronic instrumentation and measurements. Magnetic control devices. Consideration of recently developed circuit elements including saturable reactors, etc. Magnetic amplifiers.**3.605 Transistor Circuit Engineering** (Offered yearly, 1st sem.)*Preparation:* Basic Electronics and Electric Circuits*Course Content:* Non-mathematical introduction to transistor physics. Equivalent circuits and mathematical analysis of basic amplifier configurations. D-C bias circuits. Noise.**3.606 Transistor Circuit Engineering** (Offered yearly, 2nd sem.)*Preparation:* 3.605 Transistor Circuit Engineering*Course Content:* Design of audio and power amplifiers. High-frequency operation, radio-frequency amplifiers, and oscillators. Switching circuits.

3.611 Advanced Electrical Machinery (Offered yearly, 1st sem.)

Preparation: A-C Theory, A-C and D-C Machinery

Course Content: Analytical development of the principles of operation of rotating electrical machinery. Special topics in the operation of D-C machines and A-C synchronous machines.

3.612 Advanced Electrical Machinery (Offered yearly, 2nd sem.)

Preparation: 3.611 Advanced Electrical Machinery

Course Content: Special topics in the operation of transformers, A-C asynchronous machines, and fractional-horsepower machines. Transient operation of electrical machines. Theory of dynamic operation of electrical machines in servomechanisms and control systems.

3.701 Electronic Engineering (Offered yearly, 1st sem.)

Preparation: Basic Electronics and Circuits, 3.402 Transients in Linear Systems

Course Content: Laplace transform theory is extended to cover linear active circuits, with emphasis on stability considerations. Signal-flow graphs, Nyquist diagrams, log-db plots, and root-locus methods are considered. The methods are illustrated by examples from stagger-tuned amplifiers, selective R-C amplifiers, pulse amplifiers, computer amplifiers, and d-c amplifiers.

3.702 Electronic Engineering (Offered yearly, 2nd sem.)

Preparation: 3.701 Electronic Engineering

Course Content: The use of Laplace transform theory and active circuit theory in the design of vacuum-tube and transistor amplifiers which must meet exacting requirements of some sort. Stagger-tuned amplifiers with maximum gain-bandwidth product, pulse amplifiers with maximum linear ranges, amplifiers with crystal and mechanical filters, and amplifiers with minimum noise and maximum sensitivity.

3.801 Application of Microwaves (Offered yearly, 1st sem.)

Prerequisite: 3.302 Theory of Microwaves

Course Content: Review of microwave circuit theorems. Generalized waveguide theory formulated by Schwinger. Waveguide circuit elements, obstacles and discontinuities. Dielectrics in waveguides. Ferrites in waveguides—the microwave gyrator. Theory of cavity resonator and its equivalent circuits. Radiation of microwaves. Retarded potentials. Far-zone and near-zone fields due to charge and current distributions.

3.802 Application of Microwaves (Offered yearly, 2nd sem.)

Preparation: 3.801 Application of Microwaves

Course Content: Theory of the antenna. The driven antenna as a circuit element. Coupled antennas and transmission lines. The receiving antenna as a circuit element. Antenna arrays. Generation of microwaves. Klystrons and magnetrons. The periodical structures. Traveling-wave amplifiers and oscillators. Microwave measurements, including the measurements of wavelength, frequency, frequency spectrum and impedances. Theory of diffraction of microwaves. Scattering by conducting sphere, cylinder and plane obstacles.

3.803 Electromagnetic Wave Propagation (Offered 1961-62, 1st sem.)

Preparation: 14.102 Advanced Mathematics or equivalent

Course Content: Topics in wave propagation of prime importance in communications. Review of fundamentals of Maxwell's theory and wave equations. Theory of propagation over flat and spherical earth. Influence of ground constants. Theory of refraction, absorption and scattering in the troposphere. Tropospheric scatter communication characteristics.

3.804 Electromagnetic Wave Propagation (Offered 1961-62, 2nd sem.)

Preparation: 3.803 Electromagnetic Wave Propagation

Course Content: Continuation of wave propagation theory. Ionized media. Propagation through and reflection from ionized layers. Characteristics of the ionosphere and their significance to communications. Ionospheric scatter communication. Reflections from meteor trails and their use for burst communication. Survey of noise sources. Communication through random multipath media.

3.901 Electric Circuit Theory (Offered yearly, 1st sem.)

Preparation: A-C Circuit Theory, Differential Equations

Course Content: General analysis of n-loop networks by loop current and branch voltage variables using matrix algebra. Driving-point and transfer immittances. The two terminal-pair, image parameters, conventional filter theory including constant "k" and "m"-derived filters. Bartlett's bisection theorem, the symmetrical lattice, and lattice-derived filters.

3.902 Electric Circuit Theory (Offered yearly, 2nd sem.)

Preparation: 3.901 Electric Circuit Theory

Course Content: Discussion of the necessary and sufficient conditions for the physical realizability of impedance functions, positive real functions, and Hurwitz polynomials. The Foster and Cauer canonic forms for R-L and R-C networks. The Brune process as well as the work of Darlington, Cauer and Bode are discussed.

3.911 Electric Power Circuits (Offered 1960-61, 1st sem.)

Preparation: Polyphase A-C Circuits, A-C Machinery

Course Content: Review computation of line constants. Study of skin and proximity effects. Steady-state analysis of short and long lines by analytical and graphical means. Equivalent circuits. Power-factor correction. Interference with communications and other circuits.

3.912 Electric Power Circuits (Offered 1960-61, 2nd sem.)

Preparation: 3.911 Electric Power Circuits or equivalent

Course Content: Fundamentals of symmetrical components. Study of impedance to sequence currents of short and long transmission lines, cables, transformer banks, and machines. Grounding of power systems. Application of symmetrical and related components to steady-state analysis of balanced and unbalanced power circuits.

3.915 Electric Power Distribution (Offered 1960-61, 1st sem.)

Prerequisite: 3.912 Electric Power Circuits or consent of instructor

Course Content: Loads and their characteristics, including distribution, density, growth, demand, diversity factor, load factor, power factor, power and lighting loads; types of distribution systems, D-C and A-C; primary distribution, including radial and network, substation location, arrangement of primary circuits, regulation, primary voltage; secondary distribution, including radial, network, feeders, transformers, regulation; transformer size, location, loading connections, and characteristics; voltage regulation; protective devices; overhead and underground construction.

3.951 SEMINAR (Open only to co-operative students)

Course Content: A comprehensive survey of the literature in the field of the student's proposed thesis. Written and oral reports summarize the survey findings. A two-hour class session is held each week during which the student is informed about library survey methods or discusses topics of current scientific interest led by faculty or guest lecturers.

3.953 THESIS (Open only to co-operative students)

Course Content: Analytical and/or experimental work conducted under the auspices of the department.

3.954 THESIS

Course Content: A continuation of 3.953.

CHEMICAL ENGINEERING

GRADUATE CO-OPERATIVE PROGRAM

CURRICULUM—

MASTER OF SCIENCE IN CHEMICAL ENGINEERING

FIRST YEAR

1960-1961

First Term		Second Term	
4.711	Thermodynamics 2	4.822	Transport Phenomena . . . 2
4.811	Mass Transfer (Distil.) . . . 2	4.902	Thesis 2
	Electives 4		Electives 4
	8		8

SECOND YEAR

1961-1962

First Term		Second Term	
4.813	Mass Transfer (Diffus.) . . 2	4.722	Chemical Eng. Kinetics . . 2
4.903	Thesis 2	4.904	Thesis 2
	Electives 4		Electives 2
	8		6

Eight semester hours must be selected from the preferred elective courses listed below. Up to six semester hours may be selected from any of the course offerings of the Graduate School in Engineering or Mathematics provided the student has the required preparation or prerequisites.

PREFERRED ELECTIVES

(Minimum of 8 credits)

First Term		Second Term	
4.111	Prop. of Liquids & Gases. 2	4.222	Colloidal &
4.405	Fluid Mechanics &		Amorphous Mat. 2
	Heat Trans. 2	4.302	Design Eng.—
14.103	Mathematics for		Chemical Proc. 2
	Chemical Engineers 2	4.104	Computational Procedures 2

DESCRIPTION OF COURSES

COURSES OPEN ONLY TO CO-OPERATIVE STUDENTS

4.104 Computational Procedures for Chemical Engineers

Preparation: Bachelor of Science degree in Chemical Engineering, including Differential Equations

Course Content: The various computational procedures used for the solution of complex chemical engineering problems are studied and compared. The use of the IBM 650 digital computer for more rapid solutions is indicated wherever necessary.

4.111 Properties of Liquids and Gases

Preparation: Bachelor of Science degree in Chemical Engineering or Chemistry

Course Content: A presentation and critical analysis of methods of correlating and estimating the physical properties of gases and liquids.

4.222 Colloidal and Amorphous Material

Preparation: Bachelor of Science degree in Chemical Engineering or Chemistry

Course Content: Survey of colloidal science and detailed study of surface phenomena. Structure and properties of interfaces, functions and uses of surfactants; emulsification, foaming and detergency. Thermodynamics and kinetics of nucleation and crystal growth. Adhesion and adhesives. Application of surface phenomena to chemical process technology.

4.302 Design — Chemical Processes

Preparation: Bachelor of Science degree in Chemical Engineering

Course Content: A study of some of the techniques used by project engineers in process design. The design of a chemical process is undertaken as a student project.

4.405 Fluid Mechanics and Heat Transfer

Preparation: Fluid Mechanics and Heat Transfer

Course Content: A study of the fundamentals of fluid dynamics which are basic to an understanding of convection heat transfer.

4.711 Thermodynamics

Preparation: Chemical Engineering Thermodynamics

Course Content: A thermodynamic analysis of processes of interest to the chemical engineer. Thermodynamics is used as a tool and a method of approach to the solution of industrial problems. Fundamental principles are reviewed to the extent needed.

4.722 Chemical Engineering Kinetics

Preparation: Thermodynamics, Chemical Engineering Kinetics or equivalent

Course Content: A review is made of the principles of reaction kinetics. Problems for solution similar to those encountered in the design and operation of reaction equipment are selected to illustrate important principles.

4.811 Mass Transfer (Distillation)

Preparation: Unit Operations or equivalent

Course Content: Review of the physical chemistry background of distillation and rectification covering development of phase equilibria relationships and thermodynamic evaluation of experimental data. This is a more complete and advanced treatment of distillation than is possible in an undergraduate course.

4.813 Mass Transfer (Diffusion)

Preparation: Unit Operations or equivalent

Course Content: Development of basic rate equations for mass transfer involved in the transfer of materials between phases. Absorption and extraction processes are studied.

4.822 Transport Phenomena

Preparation: Unit Operations or equivalent

Course Content: A consideration of the relationships of Mass, Momentum and Energy Transfer. Fundamental equations of change covering the transport of momentum, heat and mass are developed to illustrate the essential unity of the transport processes. Molecular, microscopic and macroscopic systems are studied. It will be seen that much of the theory behind the engineering calculations on which the Unit Operations of chemical engineering are based can be organized and integrated in terms of equations of change.

4.902 THESIS

Course Content: Analytical and/or experimental work conducted under the auspices of the department.

4.903 THESIS

Course Content: A continuation of 4.902.

4.904 THESIS

Course Content: A continuation of 4.903.

COURSES OFFERED IN THE EVENING ONLY

4.241 Corrosion Fundamentals (Offered 1961-62, 1st sem.)

Preparation: Bachelor of Science degree

Course Content: Economic factors, basic theories, types, behaviors of specific systems and protection against corrosion are studied. Wherever possible, engineering applications of the principles studied are emphasized.

4.503 Chemical Data Estimation (Offered 1961-62, 2nd sem.)

Preparation: Bachelor of Science degree

Course Content: Methods of obtaining physical and thermodynamic properties of chemical compounds and systems without resorting to laboratory investigations. Latest empirical relationships and physical and thermodynamic laws are introduced to obtain data for plant design and other chemical and engineering uses.

ENGINEERING MANAGEMENT EVENING PART-TIME PROGRAM

CURRICULUM—

MASTER OF SCIENCE IN ENGINEERING MANAGEMENT

Applicants for this program should have a Bachelor of Science degree in Industrial Engineering. Applicants with degrees in other branches of engineering will be required to make up any deficiencies in industrial management, accounting, and statistics. The Graduate School offers certain courses to satisfy these deficiencies.

Required Courses:

5.101	Analysis of the Industrial Enterprise	2
5.102	Engineering Economy	2
5.201	Finance	2
5.202	Industrial Budgeting	2
5.203	Industrial Forecasting	2
5.301	Manufacturing Analysis	2
5.401	Marketing	2
5.601	Human Factors in Industrial Operations	2

Elective Courses:

Four semester hours must be selected from the following preferred elective courses in the student's major field. Ten additional semester hours may be selected from any of the course offerings of the Graduate Engineering or Science Programs provided the student has the required preparation and/or prerequisites.

Preferred Electives:

5.103	Engineering and Research Administration	2
5.104	Engineering Surveys and Reports	2
5.106	Executive Development	2
5.304	Advanced Work Measurement	2
5.305, 306	Advanced Quality Control	4
5.501, 502	Introduction to Operations Research	4
5.602	Seminar in Contemporary Industrial Problems	2
5.603	Labor Relations	2
3.204	Digital Computer Coding and Logic	2
9.950	The Systems Approach	2
14.101, 102	Advanced Mathematics	4

DESCRIPTION OF COURSES

Non-credit courses for the purpose of fulfilling deficiencies in order to proceed with the Engineering Management program.

5.50 Industrial Management (Offered yearly, 1st sem.)

Preparation: Bachelor of Science degree in Engineering

Course Content: An introduction to the general problems of competitive industry and modern scientific management methods. Origin of the factory system, development of management principles and types of organizational structures; overall policies; plant location and layout; machinery and equipment; transportation and material handling; plant services, maintenance; research, patents, design and development; manufacturing economics.

5.51 Industrial Management (Offered yearly, 2nd sem.)

Preparation: 5.50 Industrial Management

Course Content: A continuation of course 5.50 with particular emphasis on personnel management and practices. Production control, quality control, motion and time study, purchasing, selling, foremanship, wage and salary administration, job evaluation and merit rating, personnel, union relations, cost reduction and control, computers, operations research.

5.52 Industrial Accounting (Offered yearly, 1st sem.)

Preparation: Bachelor of Science degree in Engineering

Course Content: A foundation in basic principles and bookkeeping procedures. Recording of the ordinary transactions of a trading business, the preparation of financial statements and the handling of controlling accounts and subsidiary ledgers. Clerical work is minimized and stress laid on the service of accounting to management and successful business operation.

5.53 Industrial Accounting and Business Statistics

(Offered yearly, 2nd sem.)

Preparation: 5.52 Industrial Accounting

Course Content: A continuation of course 5.52 providing a foundation in cost accounting theory and practice. Introduction to budgetary practices and procedures, statement analysis and interpretation.

The latter portion of time in this course is devoted to the use of statistical data in business. A study is made of the nature, source, collection, and organization of statistical facts; the presentation of such facts in tabular or graphic form; the various averages and measures of dispersion; time series analysis; use of index numbers.

5.54 Engineering Statistics (Offered Summer, 1960)

Preparation: Business Statistics portion of 5.53

Course Content: A continuation of the statistical portion of 5.53 with emphasis on the engineering applications of statistics. Statistical inferences concerning a mean, significant differences, miscellaneous types of inference; correlation in general, including simple linear, multiple and partial correlation. Introduction of statistical theory as applied in quality control.

GRADUATE COURSES

5.101 Analysis of the Industrial Enterprise

(Offered yearly, 1st and 2nd sem.)

Preparation: Industrial Management

Course Content: A comprehensive study of the development and growth of industrial enterprises, both large and small, and the management philosophies which have spelled success or failure. An examination of the competitive relations of the companies within each industry. Financial statements; discussion of fourteen important operating ratios and trends in a wide range of American industry. Business failures and conclusions as to causes. Planning to meet customers' needs calls for discussion of market and economic research, customer research, product design and styling, and of engineering research and development. Centralized policy and decentralized administration in large organizations, and attendant problems, are examined, and their application in smaller organizations discussed. The importance of human relations; the development of executive personnel at all levels.

5.102 Engineering Economy (Offered yearly, 2nd sem.)

Preparation: Bachelor of Science degree in Engineering

Course Content: The fundamental objective is to explain the technique of answering the "Will it pay?" question in engineering situations. The time value of money; the variance of points of view of the accountant and the engineer as affecting the solution are clearly brought out. Discussions of replacement economy include consideration of the M.A.P.I. formula and theory.

5.103 Engineering and Research Administration

(Offered 1960-61, 1st sem.)

Preparation: 5.101 Analysis of the Industrial Enterprise

Course Content: Current developments in the management of research activities and the background of engineering, research, and development in industry; the responsibility of management for engineering and research programs; choice of objectives and plans, magnitude of projects and programs, evaluation of research, administration of personnel; engineering and research facilities; relationship of research to other functional areas of the organization.

5.104 Engineering Surveys and Reports (Offered 1960-61, 1st sem.)

Preparation: 5.101 Analysis of the Industrial Enterprise

Course Content: Principles and methods employed by engineers in surveying and reporting on existing and proposed industrial operations. Development of criteria for such evaluation. Problems of applying appropriate units of measurement for such criteria. Oral and written reports on an actual industrial survey.

5.106 Executive Development (Offered 1960-61, 2nd sem.)

Preparation: 5.101 Analysis of the Industrial Enterprise

Course Content: The impact of new corporate dimensions — popular ownership, professional management; public responsibility; the customer; ethical standards. The challenge of top-range planning, information for decision making, human motivation, social-political questions impinging on the business community. Managerial philosophies — decentralization and attendant problems; development of men; leading through persuasion not command; integration, teamwork, balanced communications. Sharing the vision of the future.

5.201 Finance (Offered 1960-61, 2nd sem.)

Preparation: 5.101 Analysis of the Industrial Enterprise

Course Content: A study of the financial structure of the American economy and of the financial organization of business units. An analysis of the basic principles governing the financial operations of business, including administrative tools of financial management, and the principles and instruments of short-term and long-term financing. A resumé of such topics as methods of valuing a business, promotion, expansion, consolidation, refinancing and reorganization.

5.202 Industrial Budgeting (Offered 1960-61, 1st sem.)

Preparation: Industrial Accounting

Course Content: Budgeting in industry today. The introduction of budgeting procedures in business. Preparation, execution, and control of budgets. Sales, inventory, production, expense, cash, research, and investment budgets.

5.203 Industrial Forecasting (Offered 1960-61, 2nd sem.)

Preparation: Industrial Statistics

Course Content: The classical techniques of forecasting and their relative advantages and disadvantages. Particular emphasis is directed toward the necessary requirements and aptitudes of the forecaster himself — his scientific approach, familiarity with the questions to be answered and the uses that will be made of those answers; knowledge of sources of data within and outside of the company; resourcefulness and ability in developing his own data in the field; devising procedures for pretesting the product, the advertising, the promotion, the distribution, and most important, the sales performance. Forecasting as an aid to management in making long-range plans.

5.301 Manufacturing Analysis (Offered 1960-61, 2nd sem.)

Preparation: Bachelor of Science degree, Industrial Statistics, Industrial Management.

Course Content: Study of the development of conceptual models to represent industrial operations and study of the usefulness and limitations of such models provides an introduction to the more intensive treatment that will be provided in the Operations Research sequence that follows as an elective area. Models included are process flow charts, Gantt charts and other

schematic models as well as more intensive study into mathematical models such as linear programming, Monte Carlo analysis, analysis of variance, and total value analysis. Some aspects of the use of large computers in the treatment of such models is studied.

5.304 Advanced Work Measurement (Offered 1960-61, 1st sem.)

Preparation: Bachelor's degree in Industrial Engineering or equivalent

Course Content: Critical evaluation of methods and time study procedures and research techniques including systems analysis, memo-motion, work sampling, construction of standard data, conveyor line balancing and multiple machine operations. Curve and nomograph construction, multi-variable charts. Predetermined time systems. Financial and non-financial incentives.

5.305 Advanced Quality Control (Offered 1960-61, 1st sem.)

Preparation: 5.301 Manufacturing Analysis

Course Content: Inspection versus quality control. Standards of quality. Economics of quality. Organization for quality control. Acceptance of quality-inspector's errors. Paper work involved. Process capability analysis—the Span Plan. Analysis of results.

5.306 Advanced Quality Control (Offered 1960-61, 2nd sem.)

Preparation: 5.305 Advanced Quality Control

Course Content: Total quality control. Statistical aspects of design, production, and measurement. Assembly tolerances, detection of causes of defects. Control charts for continuous variates, fraction defective, and number of defects. Bases for selection of sampling plans, and critical evaluation of various plans.

5.401 Marketing (Offered 1960-61, 1st sem.)

Preparation: 5.101 Analysis of the Industrial Enterprise

Course Content: The structure and operation of our distributing mechanism and the functioning of its various parts. The Federal Trade Commission and its enforcement of interstate commerce and foreign trade legislation as affecting trade practices; trade association activities, permissive and barred. Various aspects of marketing such as product development, market research, direction of the sales force, advertising, warehousing, and other distribution costs, all as affected by competitive pricing and distribution policies. The role of service. Value from the buyer's standpoint.

5.501 Introduction to Operations Research (Offered 1960-61, 1st sem.)

Preparation: 5.301 Manufacturing Analysis

Course Content: An introduction to the various techniques used in Operations Research, i.e., the development of mathematical models for industrial decision problems, followed by a more intensive study of linear programming and some total value maximization and minimization models such as optimum inventory. Study of actual problem situations is emphasized.

5.502 Introduction to Operations Research (Offered 1960-61, 2nd sem.)

Preparation: 5.501 Introduction to Operations Research

Course Content: A continuation of the study begun in 5.501 commencing with a consideration of incremental analysis in optimization models. Later study concerns the influence of uncertainty in mathematical models including emphasis on total value and incremental analysis problems as well as some treatment of queuing theory. Both rigorous mathematical developments and approximation techniques such as the Monte Carlo technique are considered. Here again study of actual problem situations is emphasized.

5.601 Human Factors in Industrial Operations

(Offered 1960-61, 1st sem.)

Preparation: Bachelor's degree in Industrial Engineering or equivalent

Course Content: A consideration of the knowledge and methods in the field of management of human relations in industry. Emphasis is placed on the effects of various patterns of human organization on morale and effectiveness. Topics discussed include executive education, formal and informal organization, motivation, and communications.

5.602 Seminar in Contemporary Industrial Problems

(Offered 1960-61, 2nd sem.)

Preparation: 5.101 Analysis of the Industrial Enterprise

Course Content: Study of contemporary industrial and economic issues and developments. Development of facility in appraisal of current trends. Stimulation of interest in business relationships with government, labor, and the public.

5.603 Labor Relations (Offered 1960-61, 2nd sem.)

Preparation: Bachelor's degree in Industrial Engineering or equivalent

Course Content: This course considers the historical background as well as the current scene in labor relations. The role of the union, how it has developed, the role of management, its development, and the role of the public as developed in the legislation are all considered. Some attention is paid to foreign labor movements by way of contrast, but the main emphasis is on the scene in the United States. Topics considered are union organization, forms of collective bargaining, union-management co-operation, Wagner Act, Taft-Hartley Act, and the Landrum-Griffin Act.

NUCLEAR ENGINEERING

Consideration is being given to the need for a graduate program in Nuclear Engineering, to be offered in the evening. The following courses cover introductory material which would be needed in such a program. These courses are open to graduates with a Bachelor of Science degree and may be used as electives in any engineering program.

15.223 Nuclear Physics for Engineers I (Offered 1960-61, 1st sem.)

Preparation: 14.102 Advanced Mathematics

Course Content: Atomic structure with emphasis on the nucleus. Study of radiation. Characteristics, transmission, absorption, detection, and measurement. Nuclear reactions. Isotope formation and radioactive decay. Cross sections for absorption, scattering, fission.

15.224 Nuclear Physics for Engineers II (Offered 1960-61, 2nd sem.)

Preparation: 15.223 Nuclear Physics for Engineers I

Course Content: Motion of charged particles in electromagnetic fields; motion of plasma in electromagnetic fields; Debay lengths, penetration of plasma in magnetic fields. Pinch effect and other principle applications.

GENERAL ENGINEERING

9.950 The Systems Approach (Offered 1960-61, 1st sem.)

Preparation: Bachelor of Science degree in Engineering

Course Content: This course is intended for graduate engineers who have had some experience in the management of system development projects, or who expect to get that opportunity in the near future. The course will provide an operational definition of the systems approach by relating the formal and empirical aspects of the scientific method to the orderly development and objective evaluation of such complex man-machine data-processing systems as air traffic control, missile guidance, radar early warning, etc. The lectures will cover in a qualitative way a variety of mathematical models useful in the rational design of the system, including probability, game theory, decision theory, information theory, linear programming, and network synthesis. Simulation on analog and digital computers will be reviewed. The human operator will be considered as a sensor and decision-making element. System evaluation will be discussed in terms of the requirements for good experimental design including problem generation, performance criteria and measurement, and analysis of variance. The course will not aim at meticulous instruction in any of the individual disciplines, but will show their relationship, utility and limitations. Readings and courses will be recommended for detailed exposition. Inferences will be drawn for the management of an interdisciplinary system design team.

MATHEMATICS

DESCRIPTION OF COURSES

The following non-credit course is offered for those students whose undergraduate mathematical preparation is weak because they have not had differential equations or because they have been away from formal mathematical work for some time.

GRADUATE COURSES

14.50 Introduction to Differential Equations

(Offered yearly, 1st and 2nd sem.)

Preparation: Differential and Integral Calculus

Course Content: Standard methods of solving ordinary differential equations: equations of first order and first degree; linear equations of higher order with constant co-efficients, method of undetermined co-efficients, variation of parameters; first-order equations of higher degree; special second-order equations with variable co-efficients.

14.101 Advanced Mathematics (Offered yearly, 1st and 2nd sem.)

Preparation: Differential Equations

Course Content: Topics related to differential equations, including systems of equations, solution by Laplace transforms, and solution by series. Legendre and Bessel functions, Fourier series, orthogonal functions. Differentiation and integration of functions of several variables.

14.102 Advanced Mathematics (Offered yearly, 1st and 2nd sem.)

Preparation: 14.101 Advanced Mathematics

Course Content: Fundamental operations with vectors, linear vector spaces, matrices, linear transformations, orthogonal transformations, diagonalization of matrices, quadratic forms. Scalar and vector fields, gradient, line integrals, divergence and curl, divergence theorem, Stokes' theorem. Partial differential equations, wave equation, heat flow, Laplace equation, vibration of rectangular and circular membrane.

14.103 Mathematics for Chemical Engineers (Offered yearly, 1st sem.)

(Open only to co-operative chemical engineering students)

Preparation: Bachelor of Science degree in Chemical Engineering and Differential Equations

Course Content: A consolidation of mathematical procedures most used by chemical engineers. Attention is given to the problem of expressing a physical situation in mathematical language.

14.105 Advanced Mathematics (Offered yearly, 1st sem.)

(Open only to co-operative electrical engineering students)

Preparation: Differential Equations*Course Content:* Properties of series; absolute and uniform convergence; application of power series to solution of differential equations and approximation problems. Numerical analysis; solution of differential equations by Runge-Kutta method and by Taylor series, Sturm-Liouville systems and orthogonal functions; Gram-Schmidt procedure; Fourier-Bessel and Legendre series. Solution of partial differential equations of physics using above techniques.**14.106 Advanced Mathematics** (Offered yearly, 1st sem.)

(Open only to co-operative electrical engineering students)

Preparation: 14.105 Advanced Mathematics*Course Content:* Linear vector spaces, matrices, linear transformations, orthogonal transformations, diagonalization of matrices, quadratic forms. Introduction to the mathematics of probability and statistics; discrete and continuous probability distributions, including binomial, Poisson, and normal.**14.200 Numerical Analysis** (Offered yearly, 2nd sem.)*Preparation:* 14.201 Principles of Automatic Computation or knowledge of programming*Course Content:* Numerical solution of linear and non-linear systems of equations with aid of determinants, matrices. Newton's method, method of steepest descent, direct and inverse interpolation, Lagrange interpolation formula, Aitken's method, numerical differentiation and integration. Curve fitting by least squares with the use of orthogonal polynomials. Harmonic analysis. Each student will be expected to completely analyze, program and run at least one major problem on the University digital computer.**14.201 Principles of Automatic Computation** (Offered yearly, 1st sem.)*Preparation:* Differential Equations*Course Content:* Description of computing processes and programming of digital computers. Basic concepts of computation on a stored program computer as well as a detailed study of the preparation of specific programs in machine language and problem oriented languages for the IBM 650 Computer. Introduction to automatic programming including interpretation and compilation. Binary, octal, and decimal number systems. Application of general purpose digital computers to numerical problems in mathematics and physics.**14.205 Difference Equations** (Offered yearly, 2nd sem.)*Preparation:* 14.102 Advanced Mathematics*Course Content:* Formulation and solution of difference equations; approximate solution of engineering problems by finite-difference methods; relaxation techniques; stability and convergence of approximate methods. Applications to elastic systems, electrical networks, filters, potential theory, wave propagation, heat flow, etc.

14.220 Statistics (Offered yearly, 2nd sem.)

Preparation: 14.230 Probability

Course Content: Fundamental statistical methods. Tests of significance and estimation based on large or small samples; simple correlation and linear regression; introduction to analysis of variance and sequential analysis. Application to quality control and other engineering problems.

14.230 Probability (Offered yearly, 1st sem.)

Preparation: Differential and Integral Calculus

Course Content: Permutations and combinations; addition and multiplication theorems including Bayes' theorem. Discrete and continuous probability distributions including binomial, Poisson and normal with applications.

14.241 Modern Algebra (Offered yearly, 1st sem.)

Prerequisite: 14.102 Advanced Mathematics

Course Content: Introduction to the general algebraic properties of groups, rings, ideals, fields, and algebras.

14.242 Modern Algebra (Offered yearly, 2nd sem.)

Preparation: 14.241 Modern Algebra

Course Content: Properties of general fields; Galois fields, abstract vector spaces. General linear transformations; matrices and their properties; diagonalization and inversion of matrices. Application to solution of algebraic equations, ordinary differential equations, boundary value problems, and integral equations.

14.300 Fourier Series and Boundary Value Problems

(Offered 1961-62, 2nd sem.)

Preparation: 14.102 Advanced Mathematics

Course Content: A problem course dealing with the application of trigonometric series and integrals and related forms to differential equations and boundary value problems.

14.310 Vector Analysis (Offered 1961-62, 1st sem.)

Preparation: 14.102 Advanced Mathematics

Course Content: The theory and method of vector analysis as applied in physics and applied mathematics.

14.320 Theory of Functions of a Complex Variable

(Offered yearly, 1st sem.)

Preparation: 14.102 Advanced Mathematics

Course Content: The general theory of functions of a complex variable, Cauchy's theorem, Taylor's and Laurent's series, the theory of residues, conformal mapping, the Schwartz-Christoffel transformation.

14.321 Theory of Functions of a Complex Variable

(Offered yearly, 2nd sem.)

Preparation: 14.320 Theory of Functions of a Complex Variable

Course Content: This course continues 14.320 and extends the development

of the general theory of functions of a complex variable to more advanced topics. Application of the theory to physical engineering problems.

14.323 Theory of Functions of a Real Variable (Offered yearly, 1st sem.)

Preparation: 14.242 Modern Algebra or 14.321 Theory of Functions of a Complex Variable

Course Content: Theory of sets, metric spaces and applications to the topology of the real line and Euclidean N -space, closed and open sets, continuous and uniformly continuous functions. Connected, totally bounded, and compact sets. Heine-Borel theorem, extension theorems for continuous functions and applications to integration theory.

14.324 Theory of Functions of a Real Variable (Offered yearly, 2nd sem.)

Preparation: 14.323 Theory of Functions of a Real Variable

Course Content: Integration theory on abstract measure spaces and its specialization to Lebesgue theory on the real line Outer measure, signed measure, measurable functions. Lebesgue convergence theorem, Radon-Nikodym theorem, product measures and Fubini's theorem. Vitali coverings, Lebesgue-Stieltjes integral and applications to probability theory.

14.340 Calculus of Variations (Offered 1960-61, 2nd sem.)

Preparation: 14.102 Advanced Mathematics

Course Content: The minima of simple integrals in non-parametric form in three-space. Necessary and sufficient conditions for a minimum, fields, the Hamilton-Jacobi theory.

14.530 Partial Differential Equations (Offered 1960-61, 2nd sem.)

Preparation: 14.102 Advanced Mathematics

Course Content: Types of equations which are widely used in engineering. The vibrating string, Laplace's equation, the flow of heat. Fourier series and integrals, Bessel and Legendre functions, orthogonal functions.

14.540 Non-Linear Differential Equations (Offered 1960-61, 1st sem.)

Preparation: Consent of the Department

Course Content: The topological methods of Poincaré, the work of van der Pol. Oscillations, non-linear resonance, and other applications.

14.550 Integral Equations (Offered 1960-61, 1st sem.)

Preparation: Consent of the Department

Course Content: Linear integral equations, eigen-value theory, relation to infinite systems and differential equations, applications in mechanics and physics.

14.600 Differential Geometry (Offered 1961-62, 1st sem.)

Preparation: 14.102 Advanced Mathematics

Course Content: Differential properties of space curves, developable surfaces, curved surfaces, and systems of curves on surfaces.

14.700 Topology (Offered 1960-61, 2nd sem.)

Preparation: 14.102 Advanced Mathematics (may be taken concurrently)

Course Content: A survey of the fundamental problems of topology, that branch of geometry which studies those properties of geometric figures which remain invariant under bicontinuous transformations, and a discussion of its significance to most fields of modern mathematics. Detailed study of metric and general topological spaces with application to real variables, differential equations; fundamental theorem of algebra.

PHYSICS

DESCRIPTION OF COURSES

COURSES OPEN ONLY TO ENGINEERING AND MATHEMATICS MAJORS

15.101 Theoretical Physics (Offered yearly, 1st and 2nd sem.)

Preparation: 14.102 Advanced Mathematics

Course Content: The basic methods and fundamental theories forming the classical foundation of physics. A mathematical formulation of these concepts illustrates in application the standard fields of physics such as mechanics and electromagnetic fields.

15.102 Theoretical Physics (Offered yearly, 1st and 2nd sem.)

Preparation: 15.101 Theoretical Physics

Course Content: This course continues the work of 15.101 with application of the basic concepts of physics to the fields not covered in the first semester, such as thermodynamics, statistical mechanics, hydrodynamics, and, if time permits, the extension of these concepts to the more recent fields.

15.105 Advanced Physics (Offered yearly, 2nd sem.)

(Open only to co-operative electrical engineering students)

Preparation: 14.106 Advanced Mathematics

Course Content: Selected topics of theoretical physics of special interest to electrical engineers. Emphasis is placed on electrostatics and wave propagation.

15.201 Modern Physics (Offered yearly, 1st sem.)

Preparation: 15.101 Theoretical Physics

Course Content: A study of the physical discoveries made since 1900. Introduction to special relativity. The discovery of the electron; its emission

from matter. The origins of quantum theory with Planck and Einstein. The nuclear atom and the Bohr theory of hydrogen and its spectrum. Schrodinger's wave mechanics. Atomic structure and optical spectra.

15.202 Modern Physics (Offered yearly, 2nd sem.)

Preparation: 15.201 Modern Physics

Course Content: A continuation of the first semester. X rays. Wave mechanics of bulk matter: specific heats, ideal gases, crystalline solids. The atomic nucleus: natural radioactivity, isotopes, artificial radioactivity, the neutron, the proton, the positron, particle accelerators, nuclear reactions, nuclear forces, fission and fusion. Cosmic rays and fundamental particles.

15.225 Semiconductor Physics (Offered yearly, 1st sem.)

Preparation: Differential Equations

Course Content: A study of the mechanisms of conduction in solids, excess electrons and holes as current carriers, n-type and p-type semiconductors, p-n junctions, rectifiers and transistors. Comparison of metals, insulators, and semiconductors from an introductory quantum viewpoint. Considerations of surface states, crystal growth, and the effect of imperfections in crystals.

15.226 Semiconductor Physics (Offered yearly, 2nd sem.)

Preparation: 15.225 Semiconductor Physics or its equivalent

Course Content: Studies of electrical and physical properties of semiconductors, thermoelectricity, resistivity, mobility, and lifetimes of current carriers. Hall Effect, conversion of solar energy, photo-electric effects, surface effects. Scattering, diffusion, structure of p-n junctions, transistor and rectifier theory. Basic theories of wave mechanics, statistical mechanics, and band structure applied to semiconductors.

COURSES OPEN TO STUDENTS WITH THE NECESSARY PREPARATION

15.123 Introduction to the Theory of Relativity

(Offered 1960-61, 2nd sem.)

Preparation: 14.102 Advanced Mathematics

Course Content: Tensor analysis, transformation of coordinate systems. Inertial frames. Failure of Galilean transformations in electromagnetic theory. Lorentz transformations and Relativistic Mechanics. Applications. Principle of equivalence and introduction to the general theory.

15.211 Introduction to Quantum Theory (Offered yearly, 1st sem.)

Preparation: 14.102 Advanced Mathematics

Course Content: Postulational formulation of quantum mechanics. The basic theory in both operator and matrix formulation. An introduction to the philosophy and structure of quantum theory. Application to atomic spectra.

15.212 Introduction to Quantum Theory (Offered yearly, 2nd sem.)

Preparation: 15.211 Introduction to Quantum Theory

Course Content: This course continues the work of 15.211. Time independent and time dependent perturbation theory. The use of group theory and application to physical problems.

15.213 Advanced Quantum Mechanics (Offered 1960-61, 1st sem.)

Preparation: 15.212 Introduction to Quantum Theory

Course Content: Elements of quantum theory of radiation. Elements of field theory. Feynman diagrams and elementary particles.

15.220 Introduction to Nuclear Physics (Offered yearly, 1st sem.)

Preparation: 15.212 Introduction to Quantum Theory

Course Content: Radioactivity, alpha, beta and gamma ray spectra. Nuclear structure and nuclear forces. Interaction of charged particles, neutrons, and photons with matter. Detection and measurement of charged particles, neutrons and photons. Nuclear reactions.

15.222 Advanced Nuclear Physics (Offered yearly, 2nd sem.)

Preparation: 15.220 Introduction to Nuclear Physics (or equivalent)

Course Content: General properties of nuclei and theories of nuclear structure and composition. Nuclear forces and statistics. The general and formal theory of nuclear reactions.

15.231 Solid State Physics (Offered yearly, 1st sem.)

Preparation: 15.212 Introduction to Quantum Theory

Course Content: This course reviews certain aspects of thermodynamics, statistical mechanics and quantum theory for application to the theory of the solid state and develops the classical and modern theories of the solid state.

15.232 Solid State Physics (Offered yearly, 2nd sem.)

Preparation: 15.231 Solid State Physics

Course Content: This course continues the work of 15.231. A study of the optical properties of crystals and metals. Statistical mechanics of electrons. Fermi levels, Brillouin zones and modern theories of conduction. Application to semiconductors and transistors.

15.250 Plasma Physics (Offered 1960-61, 1st sem.)

Prerequisites: 15.102 Theoretical Physics or 15.504 Electromagnetic Theory

Course Content: Motion of charged particles in fields. Boltzmann theory applied to plasmas. Treatment of waves in plasmas. Charged particle interactions. Derivation of the equations of hydrodynamics. Plasma oscillations and an introduction to the theory of magnetohydrodynamics.

15.252 Upper Atmospheric Physics (Offered 1960-61, 2nd sem.)

Prerequisites: 15.250 Plasma Physics

Course Content: Mathematical formulation of idealized equilibrium atmos-

pheres. Geoelectric and geomagnetic fields. Physics of the ionosphere. Solar and cosmic radiation. Meteor physics. Theoretical and experimental examinations of current space technology problems.

15.315 Theoretical Mechanics (Not open to Civil and Mechanical Engineering majors) (Offered 1960-61, 1st sem.)

Preparation: 14.102 Advanced Mathematics

Course Content: A study of the fundamental laws of statics and dynamics. The equilibrium state and an introduction to the calculus of variations. Formulation of mechanics according to Newton, Lagrange and Hamilton. Applications.

15.316 Theoretical Mechanics (Offered 1960-61, 2nd sem.)

Preparation: 15.315 Theoretical Mechanics

Course Content: This course continues the work of 15.315 and develops the transformation theory of mechanics. Application to particles and rigid bodies.

15.503 Electromagnetic Theory (Offered yearly, 1st sem.)

Preparation: 14.102 Advanced Mathematics

Course Content: The classical theory of the electromagnetic field as described by Maxwell's Equations. The problems of electro and magneto statics.

15.504 Electromagnetic Theory (Offered yearly, 2nd sem.)

Preparation: 15.503 Electromagnetic Theory

Course Content: This course continues the work of 15.503. Time dependent fields. The basic problems in radiation propagation and diffraction of electromagnetic waves.

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